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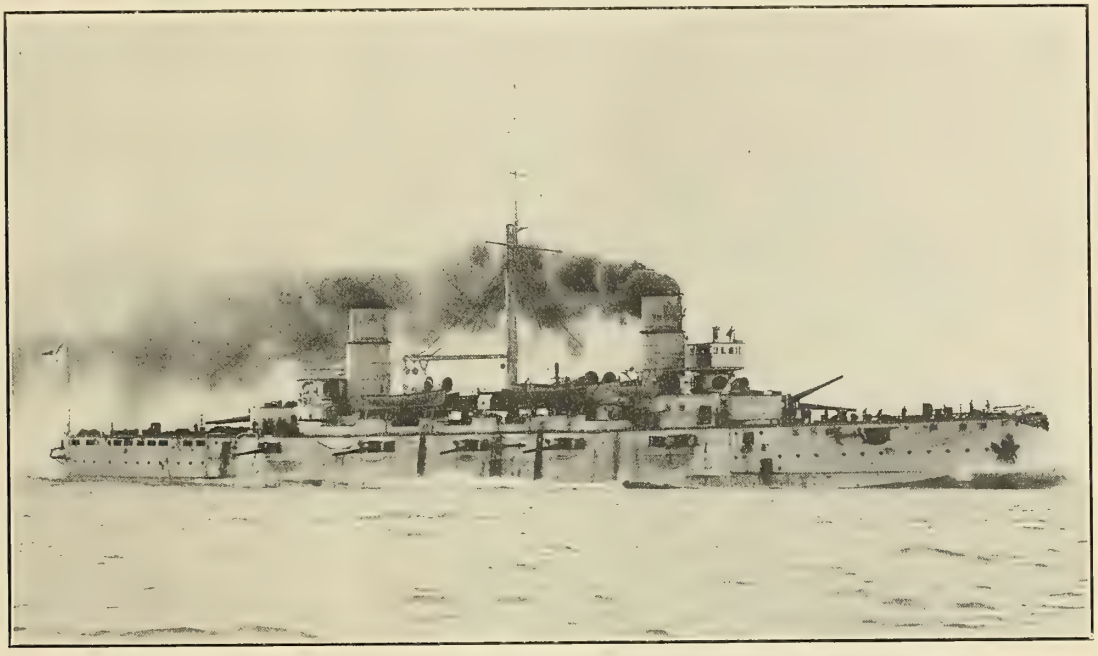
NEW CRUISERS FOR THE JAPANESE NAVY.

The cruisers *Rivadavia* and *Moreno,* built by Messrs. Ansaldo and Company for the Argentine Republic, were recently sold to the Japanese government. These ships which were practically completed at the time of sale were rechristened the *Kasuga* and *Nisshin,* respectively, and started on the morning of January 9 for Japan.

Through our correspondent in Italy, the following information relative to these ships and their official trials are given:



JAPANESE PROTECTED CRUISER NISSHIN, PURCHASED FROM ARGENTINA, ON TRIAL NOVEMBER 6, 1903.

In the Italian naval programme, dating back to 1891, there was provided for the construction of a warship to be named the *Guiseppe Garibaldi,* to be built and engined complete and delivered to the government in six years from the date of contract. The contract was taken by Messrs. Ansaldo and Company, and the vessel was launched and the engines completed twenty-two months from the date of laying the keel; this was in June, 1895.

The relations between the Argentine Republic and her sister republic, Chili, became so estranged that war seemed imminent, and the two countries looked about to purchase warships to strengthen their fleets. Overtures were made by the Argentine Republic to the Italian government for the purchase of the *Garibaldi,* and it was arranged that the builders should have power to dispose of the vessel to Argentina on condition that a duplicate of the ship be delivered to Italy within the time originally stipulated for the first one; and with the proviso that the builders were to fit the new vessel with water-tube boilers in place of the cylindrical ones of the *Garibaldi,* and that all material of the new ship should be obtained in the Kingdom of Italy, as far as possible.

The name *Garibaldi* was retained for the Argentine vessel and she was speedily completed and handed over to the Argentine authorities. Fitting the machinery on board was a remarkably smart piece of work for any country, the engines and boilers being ready for their steam trial ten weeks after the vessel was launched. The keel of second ship was laid on September 25, 1895, and construction so pushed forward that she was ready for sea long before the time originally stipulated. It was at this juncture that Spain, seeing the urgent necessity of adding to her fleet some modern and really serviceable vessels, decided to purchase the *Garibaldi* No. 2, if it were possible, and the Italian government was again approached with a request for the sale of the second vessel. This was again granted on the same terms as before, but with a distinct warning from the Italian ministry of marine that on no account would any extension of time for final delivery be granted, and

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any fines for delay would be most strictly enforced. The launch of this second vessel took place on September 16, 1896, and she was christened the *Cristobal Colon.*

A third ship was laid down in October, 1896, launched in September, 1897, and rapidly completed, and again Argentina coveted her, and got her, the ship being named the *Pueyrredon,* fitted with Belleville boilers.

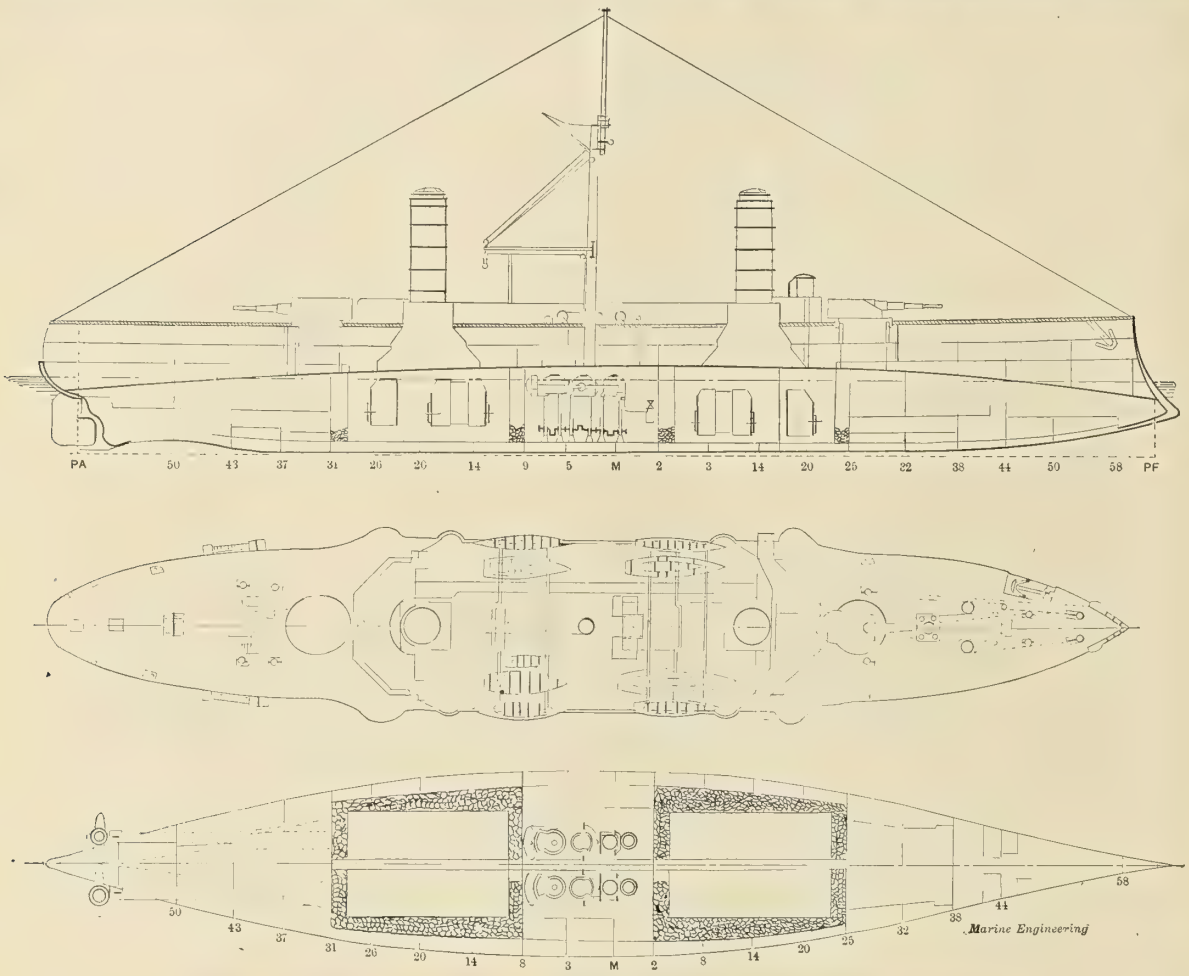
Messrs. Ansaldo now laid down the fourth and final ship for the original Italian order, and this is named *Guiseppe Garibaldi.* Her keel was laid in September, 1898, and the launch took place in June following, or about nine months from laying the keel. Construction of the vessel was well advanced at time of launching, the shafting was in place, and finished up to the engine room, auxiliary machinery was installed and all double bottom pipes and valves and bilge pipes and valves were fitted in place and finished.

These four vessels, it will be seen, have been floated within about four years from beginning of the first ship, which is a fine performance, and gives a good example of the rate of construction carried on in this yard.

Two new cruisers were contracted for by the Italian government and these were named the *Rivadavia* and *Moreno.* The over-all dimensions of these six ships, the arrangement of water-tight sub-divisions, disposing of armor, guns, and machinery, are much alike, but the details are worked out differently. The *Cristobal Colon,* the second vessel, presented some improvements which were found desirable or necessary from experience with the *Garibaldi.* Principle among these is the modification in the disposing of the 6-inch quick-firing guns at the forward and after ends, so that they may be brought to bear bow and stern on respectively.

Again have the ships from this famous yard passed into other hands. Argentina is now at peace with her neighbors and has entered into a close treaty with Chili by which both countries agreed to dispose of their new warships. When Japanese officials were looking for new ships for their government they were successful in purchasing from Argentina these two vessels, the *Rivadavia* and *Moreno,* and rechristened them the *Kasuga* and *Nisshin,* respectively. These ships are 357 feet over all, 344 feet between perpendiculars, 61 feet 4 inches extreme beam, 23 1-4 feet mean draft, 13,500 I. H. P., 7,400 tons displacement, and on trial attained a speed of 20 knots. The preceding ships are but 341 feet long over all, 328 feet between perpendiculars; 58 feet 8 inches beam, 23 feet draft, 6,882 tons displacement, 13,000 I. H. P., and 19 1-2 knots speed. The extra length of the two new vessels is given up to two more boiler rooms.

At the same time Chili offered for sale the two battleships *Libertad* and *Constitucion,* building for her in



ELEVATION AND DECK PLANS OF THE NEW JAPANESE PROTECTED CRUISERS KASUGA AND NISSHIN.

English yards; it is stated Russia made proposals for them, but they were sold to Great Britain.

GENERAL FEATURES.

In the case of the Japanese ships the offensive and defensive features were most carefully considered, the battery being so laid out that the maximum amount of destructive gun-fire can be concentrated against the enemy in any direction, the armor and water-tight bulkheads so disposed that the maximum protection is secured, and the propelling machinery and fuel such that the maximum speed and radius of action compatible are obtained. Another feature considered of utmost importance was that in housing the officers and crew in fitted with electric gear for manœuvering them from a distant point of observation. This will be a great advantage in the case of night attacks by torpedo boats, and, indeed, on all occasions when it is necessary to use them. The armor encloses a central redoubt, extending for half length of the ship, of 6 inches thickness on the sides and 4 3-4 inches at the ends. The side belt extends 5 feet above the water line and the same distance below the water line, and outside the redoubt the side armor tapers to 3 1-8 inches at the ends.

The boilers and engines are placed in six water-tight compartments formed by four thwartship and two longitudinal water-tight bulkheads. In each of the two forward compartments is one single and one double-end

JAPANESE CRUISERS KASUGA AND NISSHIN PROVISIONING AT CENOA JUST BEFORE SAILING FOR JAPAN.

the space available, their quarters be made as comfortable as possible, so that the men shall be in fit condition to get the best results out of the machinery.

The armament slightly differs from that of previous vessels, and comprises one quick-firing 10-inch gun placed in the forward barbette, on the *Kasuga,* and two 8-inch guns similarly mounted on the *Nisshin;* two 8-inch guns in the after barbette, and fourteen 6-inch rifles. The secondary battery includes ten 3-inch rapid-firing guns and four above-water torpedo tubes. The military tops with the two automatic Maxim guns were taken off. The steam hoists for ammunitions have been superseded by others of greater capacity, having electricity as their motive power, hand gear also being fitted. The electric gear for training and loading the 10-inch guns has been much improved, as also the electric firing gear for the smaller guns.

As the results of this extension of the uses of electricity on board, the electric plant has been increased 50 per cent., and four large dynamos are now fitted forward and two aft. The electric searchlights have been

boiler; in the midship compartments are the two sets of propelling engines, and in the after compartments are two boilers similar to those forward. The boiler rooms are completely surrounded both at ends and sides by coal bunkers. There are no doors between boiler and engine rooms below the water line, but all are accssible from a central gallery running along the center line of the ship with water-tight doors into each of these compartments. The engine rooms are also accessible through large skylights from the gun deck fitted with protective bars.

MACHINERY.

The main engines of each cruiser consist of two sets of three-cylinder, triple-expansion engines with cylinders 42 1-2, 63, and 93 3-4 inches diameter by 46 inches stroke, designed for 105 revolutions per minute and to develop 13,500 horse power collectively, with a steam pressure at engine of 160 pounds. The designed speed was 20 knots. The arrangement of cylinders and valves is as follows, starting at the forward end: high-pressure

piston valve, high-pressure cylinder, intermediate-pressure double-ported slide valve, intermediate-pressure cylinder, low-pressure cylinder, and the low-pressure double-ported slide valve at the after end of the engine. The sequence of cranks is as usual, namely, high, intermediate, and low-pressure.

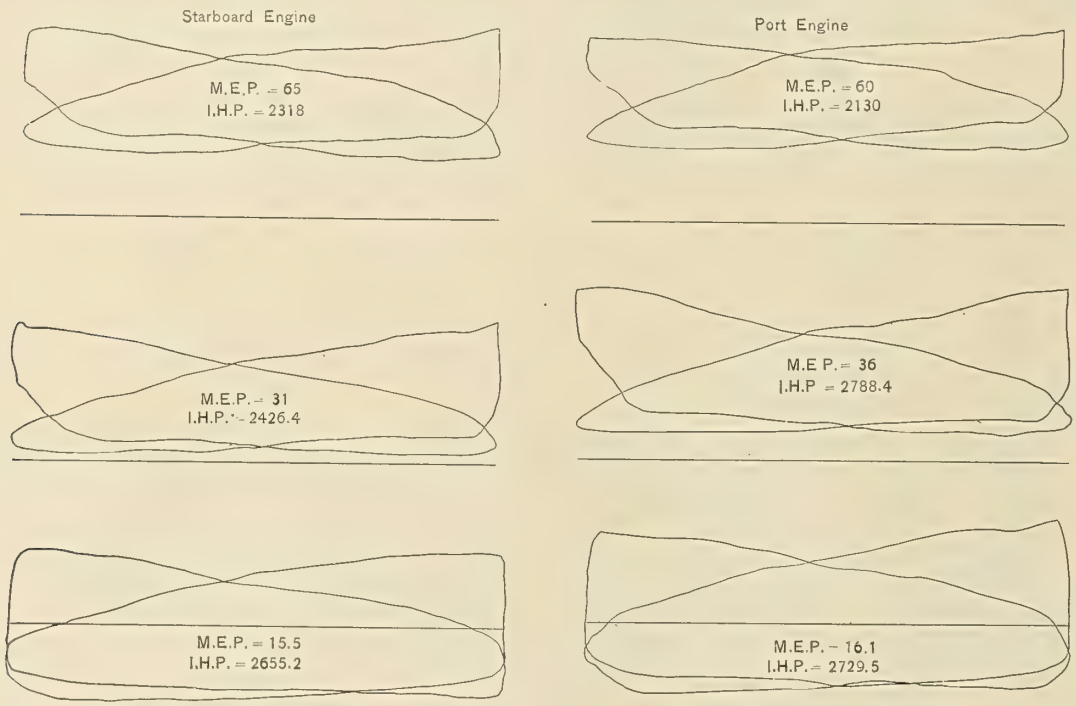
The high-pressure cylinder has one piston valve 28 inches in diameter, taking steam on the outside; the intermediate one double-ported slide valve, 53 inches wide by 59 3-4 inches long; and the low-pressure one double-ported slide valve, 60 1-2 inches wide by 90 inches long. All three valves are fitted with Joy's assistant cylinder.

The high-pressure cylinder and its chest are in two separated castings bolted together, while the intermediate and low-pressure cylinders have their respective chests in one piece with cylinder. Distance stays are placed between cylinder, allowance being made for expansion. The high-pressure cylinder has a 14-inch diameter opening for copper steam pipe on front of chest and the receiver consists of two copper pipes fitted with slip joints, one each side, 9 inches in diameter. The intermediate cylinder exhausts into two pipes 17 inches in diameter, to low-pressure chest, while the low-pressure cylinder exhausts through a 31-inch diameter copper pipe with a slip joint at condenser.

The cylinders are jacketed. A 2 1-2-inch copper pipe connected to throttle-valve casing supplies steam to intermediate and low-pressure cylinder chest directly for starting, and supplies steam for jackets; the circution of steam through jackets is not continuous from one cylinder to the other, but drains at each one, and the pressure is reduced at intermediate and low-pressure cylinders. The lagging of cylinder and chest is of steel varnished, with vertical joints. The filling in with non-conducting material is most thorough, bonnets, sides, and bottoms, with all intermediate space and pipes thoroughly covered. The pistons are all of cast steel coned. Each cylinder is supported by four cast-steel columns with cast-iron crosshead guides bolted on their face and standing on cast-steel main-bearing frames. The main-bearing caps are of forged steel with a brass bush, and, as the bottom boxes, are lined with white metal. Water circulating is provided through top and bottom boxes. There are two bearings to a crank.

The main valves are operated by Stephenson link motion, double bar links, with eccentric rods 6 feet 1 1-2 inches centers. The reversing gear consists of a direct-acting steam two-cylinder engine. The reversing shaft is 8 inches diameter, with cast-steel arms of 24 inches centers.

The connecting rods are 7 feet 8 inches centers, 7 inches diameter at fork end, 7 1-2 inches at crank end. Crank end has brass bushes lined with white metal, 16 1-2



Boiler Pressure	160 lbs.
Receiver H.P.	155 "
" M.P.	64 "
" L.P.	14 "
Vacuum	26.5 inches
Revolutions	106.5
I.H.P.	7400.

I.H.P. for the two Engines 15048

Boiler Pressure	160 lbs.
Receiver H.P.	158 "
" M.P.	70 "
" L.P.	15 "
Vacuum	26 inches
Revolutions	106
I.H P.	7648

Marine Engineering

INDICATOR CARDS TAKEN ON FORCED DRAFT TRIAL OF KASUGA.

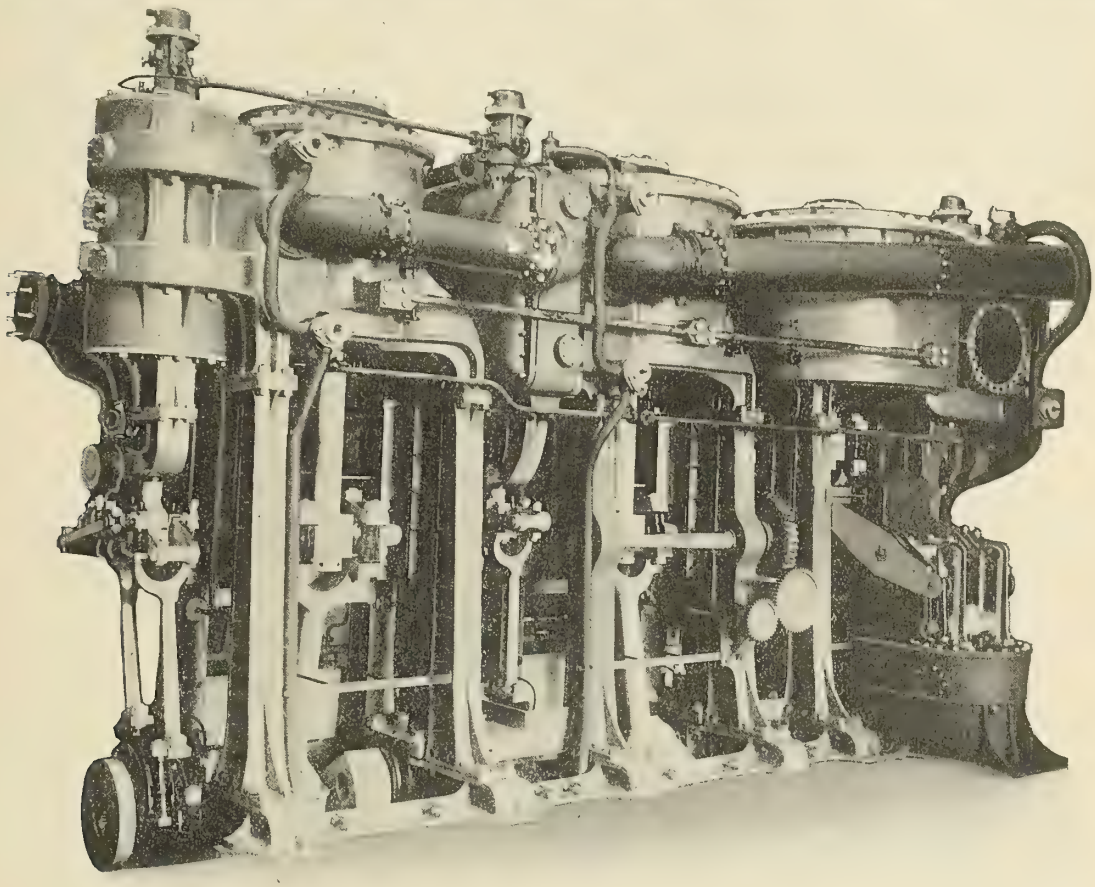
inches diameter, 19 inches long, while crosshead end has brass boxes each 9 1-2 inches diameter by 12 inches long. The slippers of crosshead are of cast iron, bolted to crosshead, faced with white metal and with astern surface two-thirds of ahead. The piston rods are 8 1-2 inches diameter in stuffing box, flat coupled in pistons, and tapered at cross head. Metallic packing is used for both piston and valve-stem stuffing boxes.

The shafts are of forged steel, hollow throughout, and the crank shaft is made interchangeable in three parts. The thrust shaft is 16 inches diameter, 50 inches long, with 7 collars 2 inches thick, 27 inches diameter. The thrust bearings are of cast iron with cast-iron horseshoes lined with white metal, and each shoe has water circulation, and collars of shaft also run in oil bath. Steady bearing is provided at fore end.

The tail shaft is 16 1-2 inches diameter, 65 feet over all, with brass sleeves for bearing, and covered with brass liners between the sleeves; the joints between liners being male and female with a white metal ring, calked. The total length of one line of shafting from forward coupling of the high-pressure cylinder to end of tail shaft is 164 feet. Steady bearing are of cast iron, lined on bottom with white metal, six on each line of shafting.

Each propeller is a true screw, three bladed, with brass hub and blades of the dimension indicated on the table. A complete oil and water system is provided extending to all parts of the main engines. The oiling is by wick feed, from brass oil boxes on cylinders for main moving parts, separate boxes being fitted for each main bearing and eccentric. Water circulation is provided for guides, main bearings, and trust-bearing shoes—sprays and pipes for all other parts, with a very complete system of cocks and swing joints. All piping is of brass.

The condenser is of sheet steel 3-8 inch thick, 6 feet 3 inches inside diameter, 9 feet 4 1-2 inches long between the tube plates. The heads are of brass. The circulating water is passed twice through the condenser, being supplied by a compound engine of 80 horse power. On the four preceding ships the condensers were of brass throughout the oval form.



ONE OF THE 3-CYLINDER, TRIPLE-EXPANSION ENGINES OF THE JAPANESE CRUISER KASUGA.

A large feed pump is fitted in each engine room capable to feed all the boilers at once; and an auxiliary water feed pump is in each boiler room, sucking from the hot well, from the water tanks, and from the sea.

Each vessel has four double-end and four single-end Scotch boilers that supply steam at 165 pounds gauge pressure. The boilers are arranged in two compartments forward and in two aft. Forced draft is applied to the ash pits. Air is supplied by twelve fans 5 feet diameter. The steam piping, which is of steel with cast-steel bends, comprises two main lines laid along each side of the vessel to the engine room, and so fitted that both engines may be supplied from one or the other line.

Feed-water heaters are fitted inside the boilers and are

of Pautrie type. The temperature of water was 260 degrees Fahrenheit when boilers worked at full power.

The steering engines are of Roger type and the stockless anchors are of the Hall type. The maximum coal supply of 1,100 tons will give a radius of action of 9,000 miles at 10 knots.

SPEED TRIALS.

The *Kasuga* had a dock trial on June 18, at which the engines were run for eight hours at 52 revolutions, half the time being supplied with steam from the forward boilers and the other half from the after boilers. On October 5, the *Nisshin* was given a similar trial. On July 22, the *Kasuga* was tried at sea under natural draft, off Genoa, the trial lasting six hours, and on October her sister ship underwent a similar trial. The full power trials were run on later dates. As the ships are similar and the results alike the data for only the *Nisshin* are given.

Shipbuilding in Japan.—The Kobe Shipyard.

The rapid progress of the shipbuilding industry in Japan, achieved for the past ten years, is a well-recognized fact, as well as the expansion of her sea power, since the Japan-China war. Her present determined attitude toward Russia is only possible because of her strong military and commercial position resulting from a powerful navy, a prosperous merchant marine, and good shipbuilding facilities. Those who heard of the failure of building gun boats for the Philippine government, at the Uraga Dock Yard Company, are doubtful of the ability of shipbuilders in Japan. However, this company is by no means representative of Japanese shipbuilders. There are only two first-class yards, equipped for large work, in the country, one at Nagasaki and the other at Kobe.

The victory of Japan over China in the Japan-China war brought the Kawasaki Dock Yard Company of Kobe to a position of eminence throughout the Orient. The yard had been the government navy yard until May, 1886, when its ownership was transferred to Mr. S. Kawasaki, the late member of the House of Peers. During the last year the regular number of men employed varied from 3,000 to 4,000, and the yard is equipped with every kind of modern machinery, electric and pneumatic. While at present there are nine shipbuilding berths and a fine graving dock, 407.6 feet in length, 63.6 feet in width of the entrance, 23.9 feet in depth, the demand for work and repairs is so great that this company is contemplating the construction of much larger berths and docks.

Steel castings and forgings, which had been looked

MARINE ENGINEERING DATA CARD. **MARCH, 1904.**

NAME—Kasuga and Nisshin. NATIONALITY—Japanese. TYPE—Armored cruisers.

LAUNCHED—1903. BUILDER—Ansaldo and Co. OWNER—Japan.

Length over all	357 ft. 0 ins.	Centrifugal, wheel diameter	48 ins.
" between perps	344 " 0 "	Engine	10 and 16 by 12 "
Beam, extreme	61 " 4 "	Feed pump	8 1-2 and 12 " 10 "
Depth	40 " 0 "	Condensers	two main, plate shell
Draft, mean load	23 " 3 "	Cooling surface, total	13,820 sq. ft.
Displacement	7,400	Two auxiliary, total surface	3,230 " "
Engines:	two triple-expansion	**Propellers:**	two 3-bladed
Cylinder diameters	42 1-2, 63, and 93 3-4 ins.	Diameter	16 ft. 8 1-2 ins.
Stroke	46 "	Pitch, mean	23 " 4 "
I. H. P., designed	13,500	" ratio	1.4
R. P. M.	100	Blade area, developed	76 sq. ft.
Speed, designed	20 knots	Material	manganese bronze hub and blades
Piston rods, diameter	8 1-2 ins.	**Boilers:** Scotch	four-double; four-single
Crosshead pins	9 1-2 diameter by 12 "	Diameter	14 ft.
Connecting rods, centers	7 ft. 8 "	Length	18 ft. 8 ins. 9 ft. 6 ins.
Crank shaft and pins, diam	16 ins.	Furnaces, mean diam.	45 ins.
" " holes	8 "	Number, each	6 3
Line " diam	15 "	G. S.	148 74
" Holes,	7 1-2 "	H. S.	4,006 2,003
Thrust and tail shaft	16 1-2 "	G. S., total	889 sq. ft.
Air pump	33 diam. by 21 "	H. S., "	24,036 " "
		Working pressure	165 pounds

TRIAL DATA. **MARINE ENGINEERING DATA CARD.** **MARCH, 1904.**

NAME—Nisshin. NATIONALITY—Japanese. TYPE—Armored cruiser.

LAUNCHED—1903. BUILDER—Ansoldo and Co. OWNER—Japan.

	Natural Draft.	Full Power.		Natural Draft.	Full Power.
Draft, forward		22 ft. 7 ins.			
" aft		23 " 11 "			
" mean, for each trial		23 " 3 "			
Displacement		7,400 tons			
Wetted surface		27,325 sq. ft.			
Immersed mid-section		1,218 " "			
Date of trial	Oct. 22, 1903	Nov. 6, 1903	Vacuum, ins	28.3	28.5
Duration	6 hrs.	100 min.	R. P. M.	94.55	106.7
Steam pressure, steam pipe, lbs	165	162	Temp., deg. F., hot well	103	114
" " H. P. value, "	160	154.5	" " boiler feed	260	264
" " M. P. " "	66	61	" " engine rooms	90	102
" " L. P. " "	12.4	13.5	" " boiler "	86	94
M. E. P. in H. P. cyl., lbs	46.9	64.1	Air press. under grate, ins		1 3-4
M. E. P. " M. P. "	27.4	34.0	Coal consumed, lbs.	112,630	45,040
M. E. P. " L. P "	12.7	14.5	Lbs. per I. H. P. per hr.	1.75	2.02
Cut off in H. P	.6	.75	I. H. P., main engines	10540	14,895
Opening of throttle	.5	.5	Speed, knots	18.7	20.4

upon as the most difficult undertakings in Japan, are also successfully made there.

As the company is practically the sole contractor to the imperial Japanese navy, many first-class torpedo boats have been constructed here. In regard to merchant work, many ocean-going steamers have been launched and are under construction by the orders of Japanese customers, Chinese, and Corean governments. In recognition of the fine equipment and output of this yard the Japanese government awarded this company the highest honorable medal at the Osaka Exhibition.

The training ship *Taisei Maru* was launched at Kobe last December for the Nautical College at Tokio, which shows their ability to build large steamers of this kind.

RUSSIAN BATTLESHIP RETVIZAN, REPORTED DAMAGED AT PORT ARTHUR IN THE FIGHT OF FEBRUARY 9. BUILT BY WILLIAM CRAMP AND SONS' SHIP AND ENGINE BUILDING COMPANY.

Length, perpendiculars, 374 feet 1 inch; beam, 72 feet 2 inches; load draft, 27 feet 3 inches; displacement, 12,700 tons. Belt, 9 inches to 4 inches; deck, 4 inches to 2 inches. Armament, four 12-inch R. F. G., twelve 6-inch R. F. G., eight 3-inch, twenty-four 3-pounders, six 1-pounders. Speed, 18 knots; I. H. P., 16,000.

[Photograph by E. Muller.]

The construction was specially arranged for sailing equipment as well as steam.

The vessel is a four-masted, full-rigged shipentine with auxiliary steam power consisting of two twin-screw, triple-expansion engines. The hull is 300 feet over all in length, 270 feet perpendiculars, 44 feet molded breadth, 26 feet 9 inches molded depth, 20 feet 10 inches draft, and of 4,300 tons displacement.

Notes on Method of Conducting Trial Trips in the German Navy.

The different navies have different methods of conducting the trial trips of their boats, and one characteristic of the Germans has been the thoroughness with which all undertakings are accomplished. As it was the writer's good fortune to be present at a trial trip of the latest German armored cruiser, *Prinz Friedrich Karl,* he had opportunity to observe the scientific and painstaking methods employed to obtain accurate and valuable results, and to note the comparison with American ways.

The scientific staff at the trial trip of the German warship was divided into three distinct branches, as follows:

1. The construction corps.
2. The engineering staff.
3. The general inspection board.

Each of these divisions had its own heads and worked independently of each other to attain the general common result. These government officials were again re-enforced by the shipyard officials, who, however, merely checked up results and did not take any actual

data, as that had been previously done at the builder's trial.

The trial trip was in charge of an official especially detailed as the head of the trial board who acted as referee in all matters wherein there was any dispute between the shipyard or government officials, but the regulations for running the trial trip are so exactly laid down and specified that these disagreements were only on minor points and could not in any way affect the results of the trial.

The trial was made in deep water, the course having been marked off with buoys, a double row of which were so placed that an accurate sight could be made on each one as the vessel passed. These buoys were placed at distances of about one-quarter mile, and a rowboat stationed at each one to keep it in position and also to make tidal corrections if necessary. Six runs each way over a five-mile course were made, the conditions being that the throttle should not be touched from the time of starting the trial until the time of finishing, and the readings of revolutions, steam pressure, indicated horse power, etc., were taken at regular intervals, including the time of making the turns. To make the turns usually occupied about fifteen minutes, as quite a distance below the course was always run, in order that as straight a line as possible could be steered; consequently plenty of room was given for heading the vessel in her course. Indicator cards were taken every five minutes on both top and bottom ends of the cylinders simultaneously, and with independent indicators placed at each end of the cylinders and a man stationed to take each card. These cards were then integrated and the areas plotted on a sheet; curves were then drawn and the whole curve integrated to find the total and mean area over the course. The revolution counter was read every five minutes, and in addition to the indicator cards mean pressure indicators were used as a check. Other readings taken were engine-room and boiler-room temperatures, temperatures of feed water, calorimetric readings of the moisture in the steam, receiver pressures, temperatures of steam at the receivers, temperature of the circulating water both at entering and leaving the condensers, temperature of the steam at entering the condenser and of the condensed water. Temperature of the feed water before and after entering the heater, the amount of steam necessary to heat the feed water, casing and up-take temperatures, and by means of a pyrometer the temperatures in the combustion chamber and stack were all recorded.

Having previously determined the initial friction of the engine from a shop trial, and the actual resistance of model from experiments at Kiel, a very close approximation of the actual efficiency of the driving mechanism was now determined. In addition a very exhaustive series of standarization runs were made under as nearly trial-trip conditions as was possible to obtain. These results were then plotted and if there was any discrepancy between the curves, showing that an error of observation had been made, the results were immediately discredited and another set of data taken.

Only the most experienced firemen, oilers, engineers, etc., are taken on these trial trips, and every possible means for insuring accuracy is adopted. Even calculations for wind resistance are made, barometric conditions, external temperatures, etc., are taken into account in order to as nearly as possible arrive at a result which can be compared with the model experimental results. The builders insist upon this, as the requirements laid down by the German admiralty are so exact and so little leeway is allowed that every possible precaution must be taken to insure accuracy. However, the results thus obtained are very nearly, if not always, of such character that they can be reproduced at any time under similar conditions. The aim of the German admiralty is not so much to have forced-draft, high-speed trials as it is to make certain that the conditions laid down have been fulfilled in a proper manner and that the contract has been complied with in every way.

The construction board meanwhile makes the most accurate determinations of the structural conditions of the boat during this trial, such as taking vibration data at various points, observing the workings of the rivets, and other structural details by means of the most careful micrometric determinations. After these speed trials are concluded, the vessel is put to every possible test involving strain upon the various structural members of the boat. These not alone include the hull and fittings, but also the structural conditions of the machinery, etc.

The engineering corps has only to do with the operation of the machinery, the construction corps being responsible for its strength, distribution, etc. The writer noticed between the gun and main decks arched stringers were worked through longitudinal and transverse members, and on inquiry learned that these had been put in to longitudinally distribute the strain from the gun platforms and sponsons. When he inquired why a distribution of the longitudinal members in the way of keelsons would not accomplish the same results, he was shown a strain diagram which had been worked out as a result of these trials, which conclusively showed that the only means of taking care of this strain would be through arched girders such as are used in pier bridges and which would carry off the strain to those members of the boat where they would do the least damage and offer the least resistance. Upon inquiring if the results obtained from these trial trips were given to the various shipyards it was learned that they are not made public in any shape or form, but held closely by the admiralty and used for reference in the design of another boat. A government official said that as the shipyards had been building a large number of boats for foreign countries, the government would not give them the result of these experiments for use in other navies, but the shipbuilder must take for granted the desirability of these structural details, which, when ordered, must be carried out.

Great stress was laid upon trim conditions during the trial. Exhaustive photographic reproductions were made to determine the squat and also wave formation. These were compared in turn with the photograph taken at the model experimental tank and any discrepancy investigated thoroughly. Accuracy to the point of which we have no conception in this country is in this wise obtained, and the admiralty is collecting a mass of information which is assisting them toward a development of some entirely new principles concerning ship construction, design, and propulsion.

A short description of the vessel may be of interest.

The *Prinz Friedrich Karl* is a steel armored cruiser, 394 feet long, 65 feet 6 inches beam, and at a mean draft of 24 feet 6 inches displaces about 9,000 tons. The vessel is fitted with three sets of engines driving triple screws. Each engine is in a separate water-tight compartment and is of the four-cylinder, triple-expansion type. Steam is supplied from Durr water-tube boilers, fourteen in number, in three water-tight compartments. The steam pressure is 225 pounds maximum, 210 pounds normal; the normal coal supply is 950 tons, the maximum coal supply being 1,500 tons, which will give the vessel a steaming radius at her most economical rate of speed of about 15,000 miles.

The armament consists of four 8.2-inch quick-firing guns, mounted in two turrets, one forward and one aft, protected by 6 inches of armor; ten 6-inch quick-firing guns, six in armored redoubts on the main deck and four in oval turrets on the upper deck between the 6-inch main-deck guns. There are in addition twelve 3.4-inch quick-firing, ten 1.4-inch, and four machine guns; four torpedo tubes, one forward and two on broadside, submerged, and one aft, above the water.

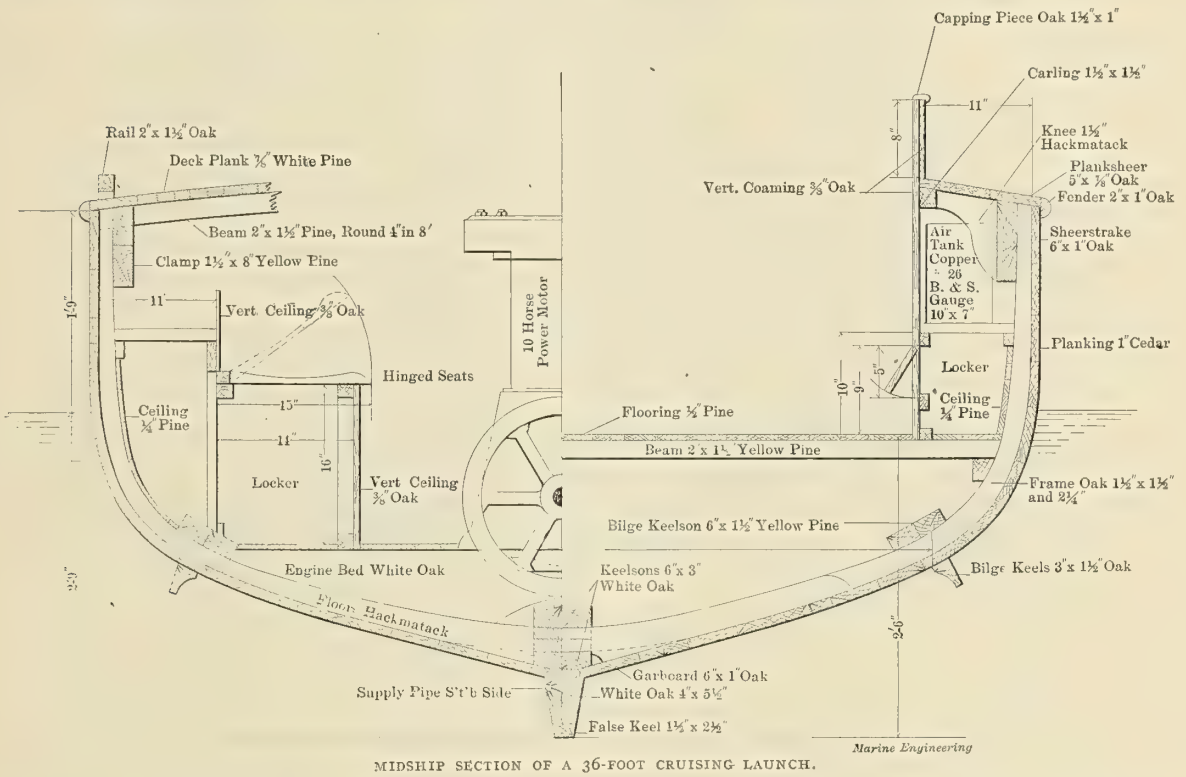
The protection is afforded by a complete water-line belt, 7 feet 6 inches high, 4 inches in thickness amidships, tapering to 3 inches at the ends. Above this there is a citadel of 4-inch steel extending for 164 feet amidships. The forward turret is raised one foot higher than the after turret, thus giving the vessel a large freeboard and good sea-going qualities. The crew numbers 550 men. With 17,000 I. H. P. a speed of about 21 knots was obtained on trial. This vessel is one of the *Prinz Heinrich* class, the first one of which was laid down in 1898.

Subscriber.

Design of a Cruising Launch.

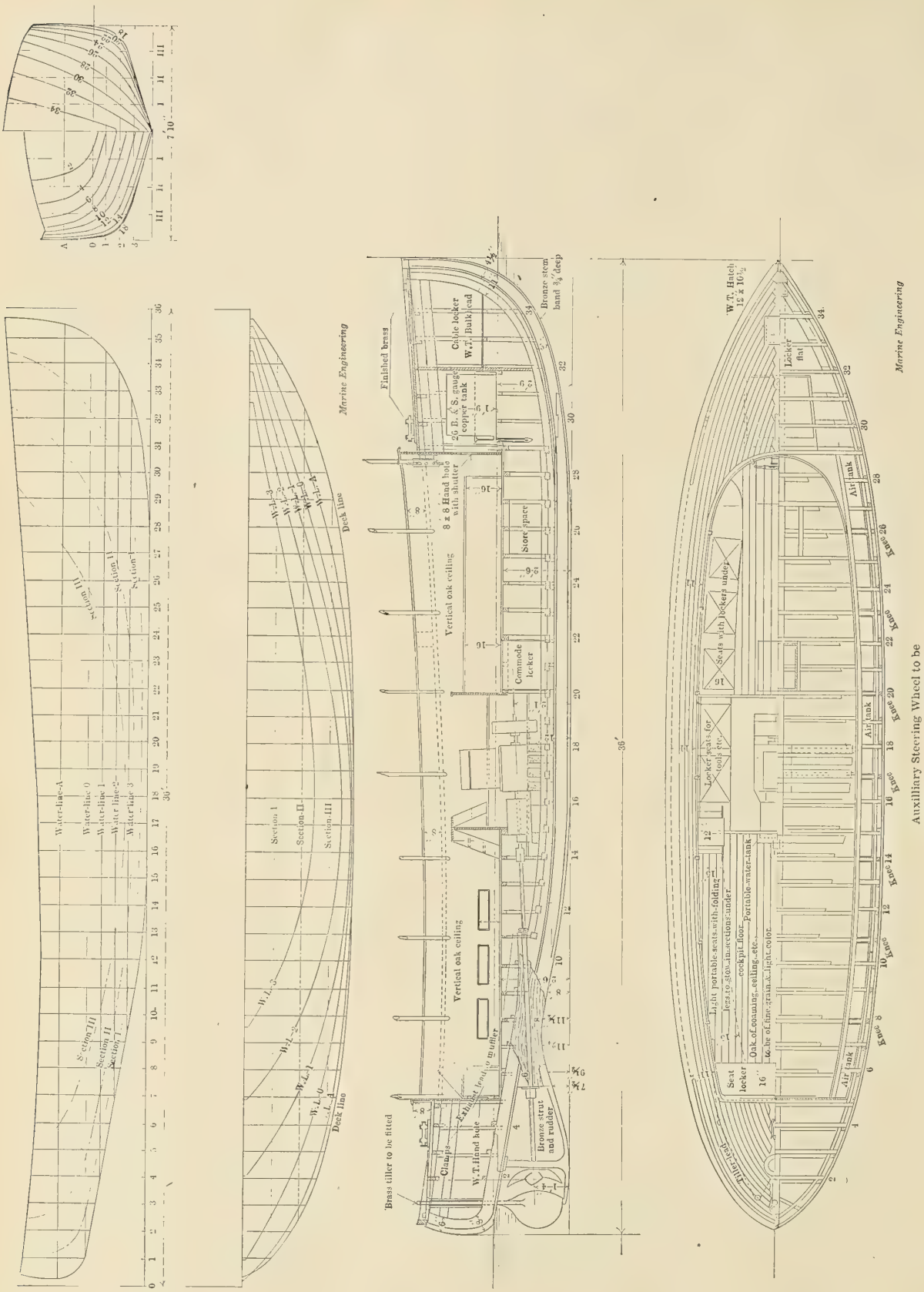
The plans of the powerful crusing launch published herewith were prepared at the offices of Messrs. John Macconnell, Jr., and George Crouse Cook, New York, N. Y., and the launch is now being constructed by the Poucher Company at City island.

The qualities required by the owner, Mr. W. A. Brown, for the launch, which is to be used about Shelter island and the lower reaches of Long Island sound, were seaworthiness, handiness, speed, and appearance; this design was therefore submitted and accepted as giving due consideration to each of these features. The dimensions finally selected were: Length over all 36 feet, length on water line 35 feet, greatest beam 8 feet, total minimum depth 4 feet 7 inches, load draft 2 feet 6 inches, corresponding displacement 12,000 pounds.


Capping Piece Oak 1½"x 1"
Carling 1½"x 1½"
Rail 2"x 1½" Oak
Deck Plank ⅞" White Pine
Knee 1½" Hackmatack
Planksheer 5"x ⅞" Oak
Vert. Coaming ⅜" Oak
Fender 2"x 1" Oak
Beam 2"x 1½" Pine, Round 1" in 8'
Air Tank Copper No. 26 B. & S. Gauge 10"x 7"
Sheerstrake 6"x 1" Oak
Clamp 1½"x 8" Yellow Pine
Vert. Ceiling ⅜" Oak
10 Horse Power Motor
Planking 1" Cedar
Hinged Seats
Locker
Ceiling ¼" Pine
Flooring ¼" Pine
Beam 2 x 1½ Yellow Pine
Frame Oak 1½"x 1½" and 2¼"
Locker
Vert. Ceiling ⅜" Oak
Bilge Keelson 6"x 1½" Yellow Pine
Engine Bed White Oak
Keelsons 6"x 3" White Oak
Bilge Keels 3"x 1½" Oak
Floor Hackmatack
Garboard 6"x 1" Oak
Supply Pipe S't'b Side
White Oak 4"x 5½"
False Keel 1⅝"x 2½"
Marine Engineering

MIDSHIP SECTION OF A 36-FOOT CRUISING LAUNCH.

The boat is broad and strong, with considerable freeboard and reserve buoyancy. The profile of the stern is of the so-called torpedo type, which is clean and dry in a seaway, and this, together with the full lines of the afterbody, will serve to keep the craft up when running hard. An open bronze strut carries the rudder and propeller, which allows the stern to be so cut away that the center of lateral resistance is well forward and the boat turns handily about a point approximately at the forward wheel. A note of the proportions will show the initial stability to be quite high, and it is, therefore, quite safe for a number of persons to sit upon the short forward or after decks for the purpose of fishing, etc. The question of speed was not of great importance in this craft and a guarantee of 10 1-2 miles in an hour's trial is all that is required. The propeller was designed to give this speed with a 30 per cent. slip, which is, for a



Auxiliary Steering Wheel to be fitted at frame 18 on starb'd side

LINES, INBOARD, PROFILE, AND DECK PLAN OF 36-FOOT CRUISING LAUNCH, DESIGNED BY GEORGE C. COOK.

craft of this type, quite large. The matter of safety was also one to which the owner asked no little attention, and, as a result, there are two watertight compartments at the ends of the boat and a series of copper air tanks fitted along the length of cockpit under the decks. These combined features will float the launch and a considerable load should the craft, by any chance, become swamped.

The arrangement of the launch is most simple and from forward aft consists of the watertight anchor cable compartment, the gasoline tank section, the forward cockpit with locker seats and storage space under the floor, the motor section with locker seats for batteries and general stores, the after cockpit with transverse locker seat and light folding side seats which are stowed under the floor, and finally the after watertight compartment containing the muffler, etc., which is reached by a screw manhole plate fitted in the deck.

The construction of the hull is strong and somewhat heavy, as desired by the owner. In fact, it closely follows the requirements of the standard United States Navy launches of corresponding size. The keel is of oak 4 by 3 1-2 inches, supported by an oak false keel; the keelson is made in two sections 3 by 6 inches each, extending from the stern to the shaft piece and morticed to allow the passage of frames and floors; the floors are of 2 1-4 by 1 1-2 inch hackmatack, 5 feet in length amidships and tapered toward the ends; the frames are of steam bent oak 2 1-4 by 1 1-2 inches at the foot and 1 1-2 by 1 1-2 inches at the head, spaced 12 inches centers to centers; the beam clamps are of yellow pine in two pieces 1 1-2 by 8 inches, morticed to receive the ends of the beams; bilge keelsons are each made from two pieces of yellow pine 1 1-2 by 3 inches and extend approximately the length of the cockpit; the deck beams are 2 by 1 1-2 inch pine with a round of 4 inches in 8 feet, and throughout the length of the cockpit a hackmatack knee is fitted in place of the partial beam; the sheer and garboard strakes are of oak 6 by 1 inch, while remainder of the planking is of 1-inch cedar not over 6 inches in width; the deck planking is to be of 1-inch white pine with 5 by 1-inch oak plank sheer; two watertight bulkheads are to be fitted of double diagonal planking with a layer of canvas between; the interior finish to be in a light grained oak made up with a vertical staving as shown.

The motor is of a 15 horsepower two-cylinder, four-cycle type, made by the Hasbrouck Motor Company, who guaranteed not only the power of the motor, but a speed above 10 miles per hour to the boat.

A 60-gallon copper gasoline tank is carried and the supply pipe to the motor is taken immediately outboard and led along the keel to the point of the vaporizer. The muffler is fitted immediately under the deck in the after compartment and the exhaust pipe opened just below the water line. At this point it may be interesting to note that actual experience with these motors has shown 15 to 20 more revolutions per minute with the exhaust below the water line than when above. The propeller is a four-bladed bronze casting of special design, with a pitch of 38 1-2 inches on a diameter of 26 inches, and an helicoidal area of 212 square inches, which will be turned between 450 and 500 revolutions when running at full speed.

31-FOOT CRUISING LAUNCH SURPRISE.

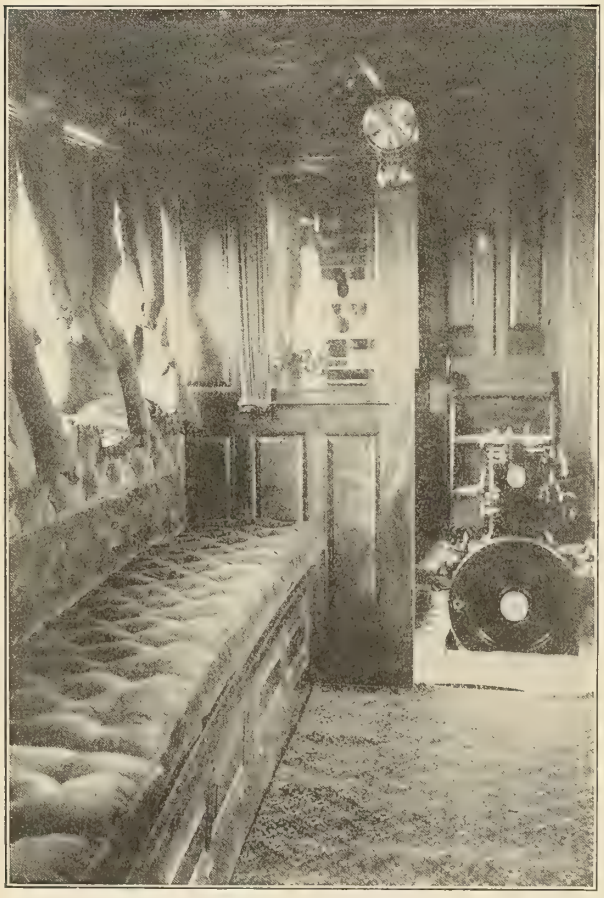
Cruising Launch Surprise.

The 31-foot motor boat *Surprise,* owned by Mr. R. W. Clemson, of Tarpon Springs, Florida, is, it is claimed, the handsomest power boat of its size in Florida waters. This boat was built from the Lozier Motor Company's design No. 3,108, Florida cruiser type, in the company's New York city shops, and was shipped to Florida by rail in December last.

The boat is 31 feet 6 inches long over all, and is built with the Lozier torpedo stern; on account of being designed for use in the shallow waters of the Florida coast, the draft is but 24 inches. The beam is 9 feet, being rather more than the average, but it makes the boat unusually roomy for its length. The entire cabin, interior and exterior, is of mahogany, and the appointments and furnishings throughout are unusually elaborate. The forward saloon is 13 feet long, providing four extension berths. On the starboard side aft of the main saloon is a brass-lined stove locker, containing two Kohtol stoves, and the top of the stove locker is a lid which can be raised when the stoves are in use. A

pull-out leaf adds to the convenience of the stove arrangement. Underneath the stove locker is a brass-lined locker for cooking utensils. Aft of this is an enclosed toilet with folding nickeled lavatory, Sands' water closet, plate-glass mirror, and mahogany brush, comb and soap racks.

On the bulkhead of the lavatory enclosure, in the engine-room, is a table locker, containing four mahogany folding tables, which are nested in a very small space. On the starboard side aft of the saloon is an extension berth for the engineer. This berth underneath is divided into compartments for ice chest and stowage



INTERIOR VIEW OF LAUNCH SURPRISE, LOOKING AFT.

spaces for engineer's supplies, etc. On the aft bulkhead is a mahogany rack for dishes and glassware.

The sliding door between the engine-room and saloon has beveled plate-glass windows, and on both sides of door in the bulkhead are also windows of French plate-glass. The gasoline tank is of 100-gallon capacity, and is in a water-tight bulkhead in the forward compartment, the fuel being carried to the engine outside of the hull.

The seats in engine-room and saloon, and the backs of seats, are upholstered to the windows with heavy tufted cushions. The saloon floor is laid with Wilton velvet carpet, and the engine-room floor is covered with linoleum. Mahogany shelf racks extend the full length of the saloon on both sides, just underneath the ceiling. The room is equipped with binnacle, ship's clock, fancy brass angle lamps, and handsome curtains are at all windows. Detachable brass-mesh mosquito screens are on all windows. Brass bands protect the stem and stern, and a heavy extension oak fender, capped by half-round brass, protects the boat when making landings.

The hull below the water-line is sheathed with 26-ounce copper. The machinery consists of a 10-horse-power double-cylinder two-cycle Lozier engine, with storage battery, a Lozier magneto, and an engineer's electric light.

Progress of Naval Vessels.

The Bureau of Construction and Repair, Navy Department, reports under date of February 9, 1904, the following degree of completion of vessels building for the United States Navy:

				Degree of Completion. Per Cent.	
BATTLESHIPS.				Jan. 1.	Feb. 1.
Missouri	18 knots.	Newport News Co.		99.9	99.95
Ohio	18 "	Union Iron Works		84.5	85.5
Virginia	19 "	Newport News Co		52.5	53.8
Nebraska	19 "	Moran Brothers Co.		35	37.7
Georgia	19 "	Bath Iron Works		42.5	45.4
New Jersey	19 "	Fore River S. and E. Co		49.43	50.3
Rhode Island	19 "	Fore River S. and E. Co.		50.61	51.7
Connecticut	18 "	Navy Yard, New York, N. Y.		26.7	28.5
Louisiana	18 "	Newport News Co.		34.5	37.55
Vermont	18 "	Fore River S. and E. Co.		2.76	3.6
Kansas	18 "	New York Shipbuilding Co.		2.6	3.9
Minnesota	18 "	Newport News Co		12	14.73
ARMORED CRUISERS.					
Pennsylvania	22 knots.	William Cramp and Sons		64.9	66.8
West Virginia	22 "	Newport News Co.		70.5	73.32
California	22 "	Union Iron Works		51	54
Colorado	22 "	William Cramp and Sons		69	71.8
Maryland	22 "	Newport News Co.		65.4	69.15
South Dakota	22 "	Union Iron Works		47	50
Tennessee	22 "	William Cramp and Sons		15.1	16.6
Washington	22 "	New York S. B. Co.		12	13.9
PROTECTED CRUISERS.					
Denver	17 knots.	Neafie and Levy		98	98
Des Moines	16½ "	Fore River S. and E. Co.		97	99
Chattanooga	16½ "	Lewis Nixon		72	72
Galveston	16⅜ "	Wm. R. Trigg Co		70.5	72
Tacoma	16½ "	Union Iron Works		99	100
St. Louis	22 "	Neafie and Levy		36.2	37.9
Milwaukee	22 "	Union Iron Works		41	42.5
Charleston	22 "	Newport News Co.		56.9	60
GUNBOATS.					
Dubuque	12 knots.	Gas Engine and Power Co.		20	25
Paducah	12 "	Gas Engine and Power Co.		16	22.2
TRAINING SHIPS.					
Cumberland	Sails	Navy Yard, Boston		12	25.5
Intrepid	"	Navy Yard, Mare Island		5	7
TRAINING BRIG.					
Boxer	Sails	Navy Yard, Portsmouth		6	10
TORPEDO BOATS.					
Stringham	30 knots.	Harlan and Hollingsworth		93	93
Goldsborough	30 "	Wolff and Zwicker		99	99
Blakely	26 "	George Lawley and Son		99	99
Nicholson	26 "	Lewis Nixon		99	99
O'Brien	26 "	Lewis Nixon		98	98
Tingey	26 "	Columbian Iron Works		100	
STEEL TUGS.					
Pentucket	12 knots.	Navy Yard, Boston		100	
Sotoyomo	12 "	Navy Yard, Mare Island		98	99

MARINE PROPELLERS WITH NON-REVERSIBLE ENGINES.*

BY RANKIN KENNEDY.

The introduction of internal combustion engines and steam turbines for marine propulsion requires the careful consideration of the fact that without some special contrivance these motors are not reversible.

The steam turbine when applied to larger vessels requires an auxiliary turbine for backing the vessel, and the high velocity of the screw propeller has been a matter for considerable experiment and one which has introduced new problems for solution.

This paper may, therefore, serve to direct attention to the consideration of other propellers than the screw, and to bring together various methods of employing the screw propeller for examination.

There are five systems whereby a vessel may be propelled and controlled when driven by a non-reversible motor:

1. By means of a screw propeller with movable reversible blades operated by a sliding rod through a hollow shaft. This is a favorite method for small craft.

2. By means of a screw propeller, and mechanical reversing gear usually in the form of friction clutches and spur wheels.

3. By two screws, a right and a left-handed screw, connected by a sliding rod through a hollow shaft, whereby either screw may be loose, and the other locked and driven, or both locked or loose.

4. By electrical control, the engine driving a dynamo and a motor driving the screw.

5. By water-jet propellers.

The writer then describes in more or less detail and illustrates the first four systems of propulsion, and then passes to the fifth heading, concerning which he states as follows:

The fifth and last system is not new, but has been used in vessels with some success. In this system the water jet propeller is adopted. This type of propeller has been discussed before in this Institution and perhaps prematurely condemned, but things have changed since then, and it may now be looked at from the non-reversible engine point of view, or with the high speed turbine as its motor power. In the early jet-propelled vessels the centrifugals employed to throw the jet were slow in speed, hence large in size, and not efficient. It may at once be admitted that the jet propeller has some well-defined limitations which will prevent it ever becoming a better propeller than a screw in large steam-driven ships employing reciprocating or other reversible engines. The column of water set in motion to produce the jet is limited in sectional area. In Ruthven's *Waterwitch,* built in 1867, the area of the jets combined was 6.28 square feet, equal to 1-53 of the midship section of the vessel, and the efficiency was 0.18. In Thorneycroft's hydraulic vessel, built in 1883, the area of jets combined was about one square foot, equal to 1-14 of the midship section, and the efficiency was 0.254. Efficiency depends to a large extent upon the sectional area of the jet being a very large fraction of the midship section.

The presence of a large volume of water on board the vessel is the chief drawback to the jet propeller. But by good design this volume can, however, be much reduced, for although the water must leave the vessel at a slow velocity in a large volume, it may pass along inside the vessel at a high velocity in a smaller column, and that is one feature to which I beg to draw your attention. A second point to which more attention should be paid is to the intake of water, for the vessel can be propelled by the suction of the pump as well as by the pressure.

In Thorneycroft's hydraulic vessels the suction intakes faced forward, so that the water entered freely with the motion of the vessel, and if the suction pipe were merely continued and led astern to an outlet, the vessel being towed, the water would flow with the speed of the vessel through the pipe, but the water would have no velocity relative to the still water outside the vessel. In Fig. 1, a diagram of a jet propeller, there is a clear passage for the water fore and aft through *A, C, B.* By means of a steam jet acting as in Morton's water lifter, the column of water can be set in motion, and by tapering the pipes it may pass quickly through the vessel as a small column, although it enters and leaves as a large column. Again, by arranging the proper size of the intake and outlet orifices, we might have a partial vacuum or suction at *A* and a pressure at *B,* both due to the impeller at *C*; and the thrust would be the sum of the forces acting at the suction and pressure orifices. It may be pointed out that in using a steam jet impeller at *C,* there would also be a reactive impulse due to the steam itself in the steam nozzle, for if the area of the steam jet orifice equalled 1 square inch, and the pressure of steam was 150 pounds, a useful effect or thrust of 150 pounds would accrue—which under ordinary circumstances is lost, and this in addition to the thrust due to the water. With some slight modifications this presents an ideal propeller, in which no engine with moving machinery is required. Although the jet propeller driven by a steam jet is not highly efficient, it may in some cases have counteracting advantages. It has one drawback when used at sea, and that is the condensed steam is lost. I need not dwell on the subject of steam jets (their inefficiency is too well known), but will pass on to the further consideration of the water jet propeller. Whatever impeller is used at *C,* there are some further points to observe.

In this simple arrangement the propulsion would be at *A,* due to suction; at *C,* due to the reaction of the steam, plus that due to the momentum of the water flowing away through *B,* outside of the vessel. To obtain the thrust of the pump due to its pressure, the water should be arrested somewhere between the pump and the outlet, so that it might flow away with the proper velocity, and produce an unbalanced pressure in the direction the vessel is to move.

The impeller was therefore made, in a recent case, to deliver the water into a pressure chamber, where its momentum was converted into pressure gradually, through cones, in the well-known manner of injectors. The water was discharged from the side of this chamber opposite in direction to the motion of the vessel. This gave good results, and is still under experiment.

*Abstracts from paper read before the Institution of Engineers and Shipbuilders of Scotland.

The impeller hitherto used has been a centrifugal pump. A diagram of this arrangement is shown in Fig. 2. The pump P delivers into a cylinder V, which, besides acting as a pressure receiver, also acts as a valve regulator whereby the vessel may be stopped, started, slowed, accelerated, or reversed by one lever without regard to the engine, which may run steadily on under a governor all the time. The valve V is made so that when it opens the forward nozzle N it closes the aft nozzle N_1, and when in the mid position, both nozzles are half open. By this means the flow of water is never violently checked, and high velocities of flow through the pumps can therefore be used. When the vessel has to stop for any considerable time, the engines are of course stopped.

This arrangement, it will be observed, is one suitable for internal combustion, and steam turbine engines which are not conveniently reversible.

As to the question of efficiencies, I am unable to give practically ascertained results of the five methods on any sufficient scale, but the theoretical results may be of interest together with the practical tests available.

In the Thorneycroft hydraulic vessel of 1883, the engine efficiency, *i. e.*, the brake horse divided by the indicated horsepower, was $\frac{\text{B.H.P.}}{\text{I.H.P.}} = 0.77$, the pump efficiency was 0.46, and the jet efficiency 0.71, which gives a total efficiency of 0.251. The remarkably low pump efficiency is surprising, and no less the engine efficiency. These figures were given as results of tests by Mr. S. W. Barnaby before the Institution of Civil Engineers.

Engines and pumps can now be obtained to give better results. Last year Mr. Konrad Andersson read a paper before this Institution, in which he stated (Table III.) the efficiency of the de Laval turbine pumps to be as high as .75 and .8. In the same paper the pounds of

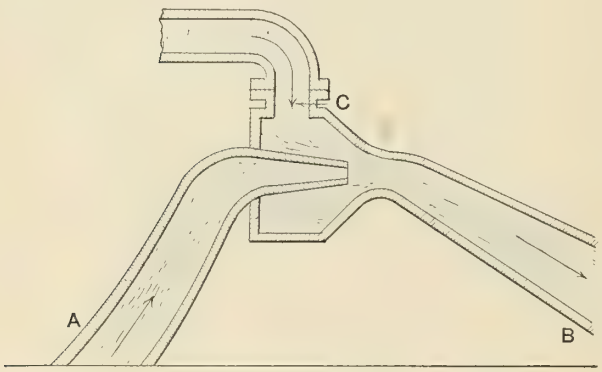


FIG. 1.

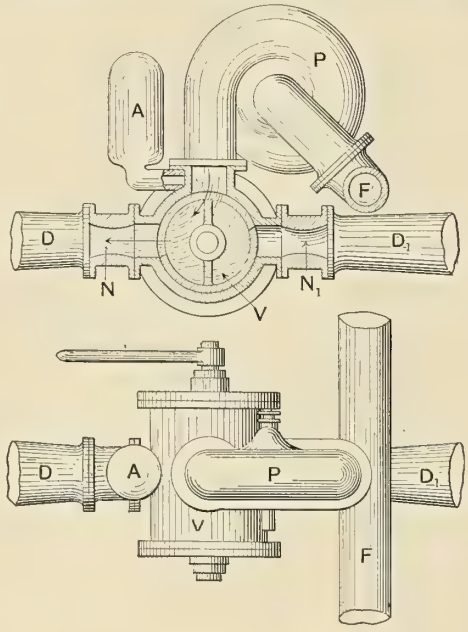


FIG. 2.

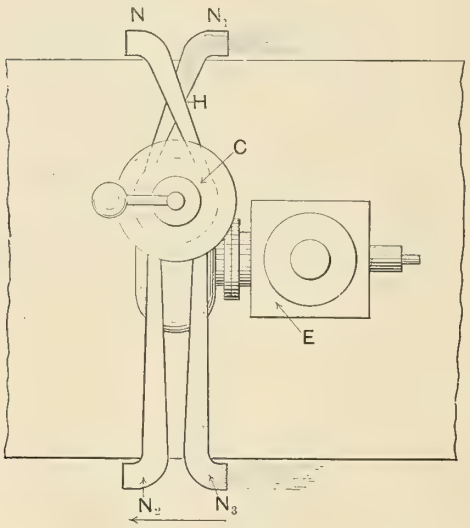


FIG. 3.

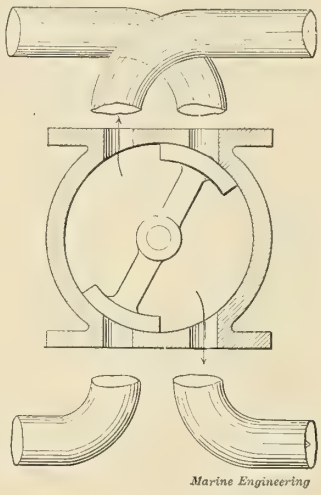


FIG. 4.

steam per brake horsepower are given, and in Table VI. the pounds of steam consumed per water horsepower are stated to be from 29 to 34.2 per hour. Taking the efficiency of the pump and engine at 0.75, and the efficiency of the jet at 0.66, then a total efficiency of 0.498 is quite possible on a consumption of steam upon the jet equal to 31 pounds per horsepower hour.

The jet propeller obeys the same law of efficiency as the screw propeller, namely—

$$\frac{V}{V + \frac{s}{2}}$$

where V = the velocity of the ship in feet per second and s the slip.

Assuming a speed of 20 feet per second for the ship and the same for the slip s, we get $\frac{20}{20 + \frac{20}{2}} = 0.66$ efficiency of the jet. The thrust would be equal to the area of the throat multiplied by the water pressure. The total reactive pressure would be that due to the velocities added, *i. e.*, 40 feet per second, and the head H would be $\frac{V^2}{2g} = \frac{40^2}{64.4} = 24.8$ feet, and the pressure due to this head = 10 pounds, nearly, per square inch. Hence an area of one square foot of nozzle would give a thrust of 1,440 pounds and the quantity of water delivered would be equal to the velocity multiplied by the area of the nozzle in feet $40 \times 1 = 40$ cubic feet per second = 2,500 pounds of water. This conclusion demonstrates the large volume of water required.

By an easy calculation the horsepower in the water in this case would be 90, and the engine indicated horsepower probably about 200.

Figure 3 illustrates in plan a form of jet propeller connected to an oil engine. The pump delivers into a vertical cylinder called the pressure chamber, shown in Figs. 3 and 4. Fig. 3 is a plan showing the delivery nozzles, N, N_1, N_2, N_3, two for going astern and two for going ahead. The pipes on one side of the boat are crossed in order to obtain a simple balanced valve for controlling the jets. This valve is shown in Fig. 4. It will be seen that either pair of tubes or jets may be opened or closed at will, and that the whole four nozzles could never be closed at once, the flow of water from the chamber being constant.

By making the valve in C double, the nozzles can be closed as desired and the boat steered by this same valve, and the pipes to the nozzles need not be in this case crossed as at H. Whatever the pressure in the chamber may be, the pipes are expanded towards the discharge, so that at the nozzle the absolute velocity of outflow does not exceed the maximum speed of the vessel.

After the discussion the author refers to the reversing internal combustion engine and describes in detail the Berthau engine, which was given in substance in Marine Engineering for December, 1903.

European Turbines.—Rear Admiral Geo. W. Melville and George Westinghouse have made a tour of inspection of the steam turbine works of Europe.

Scarfing a Bar Stem to a Plate Keel.

It may be for considerations of carrying capacity on draft, but more often for no special reasons, other than those dictated by personal opinion, that when owners and builders are planning the construction of modern passenger or cargo vessels, they increasingly favor the flat plate type of keel construction.

As usually constructed, this consists of a flat strake of plating similar to, but thicker and usually narrower than, an ordinary strake of shell plating on the same vessel, laid horizontally, upon which the vertical keel plate is fitted and connected by means of double angles. The scarfing of the rectangular bar stem and stern posts to such a type of keel was accomplished by shaping the lower portions of the stem and sternpost forgings to follow the contour of the frames so that the knuckle line formed by the flanged shell plates landing on the vertical face of the stem, dies out under the forefoot into the outside line of the plate keel without any unfairness; for the purpose of making provision for efficient riveting the inner surface of the forging at the lower extremity was scooped out.

In later vessels the lower extremity of the stem was made thinner and wider, and scooping was omitted.

In large modern vessels the lower part of the stem is often made a steel casting, scarfed to the upper part, which is the usual wrought-iron bar stem; the stern posts are now usually made cast steel. These castings are molded to conform to the shape of the ship in wake of the scarfs and in agreement with the lines plan thereafter, and to provide room for driving all the rivets possible, as tap rivets are objectionable, especially in the sternpost.

The purport of this note is to illustrate another method of scarfing a bar stem to a plate keel, as shown by the accompanying drawings.

This method has been practised for some years by two or three reputable shipyards, and some well-known transatlantic liners have their stems thus scarfed to the plate keel.

Fig. 1 shows a profile view of the part affected, the garboard strake of shell plating being removed from the starboard side; Fig. 3 is a plan of the continuous vertical center plate butted against the after side of the water-tight bulkhead on station No. 212; it is offset on the forward side in order to lap on the side of the bar stem, and is fitted in short lengths between the floors, for No. 212-217, where it ends.

Figs. 2, 4, and 5 are for the purpose of elucidating Fig. 1, and call for no remark except that they are drawn looking forward.

As will be seen by inspection, this scheme consists in carrying the rectangular bar stem to the fore peak bulkhead, the off-center intercostal vertical keel plates being lapped and riveted to the after end.

The flat keel plate is carried forward to the lap butt shown on Fig. 1, and wrought to the shape of the hull at the molded keel line to frame station 214, being thereafter knuckled from the bottom edge of the bar stem at No. 214 to the top edge at No. 216, and from there forward are the shell plating flanges against the stem in the usual way. The number of rivets fastening the plate keel to the stem reaches the full number usual

only at the extreme forward end, between frames Nos. 216-217; from there the number gradually diminishes, vanishing at No. 214. The plate keel is not connected directly to the stem from No. 214 aft to No. 212, but indirectly through the frames, floors and intercostal vertical plate. The part of the plate keel coming on the face of the stem is tap riveted at No. 215, one tap only being necessary to provide a calking edge; and from there forward is cut away.

The sizes of stem bar, rivets, and clips are given for the purpose of indicating the proportions of the parts affected. The advantage of this scheme of stem scarfing, as compared with the others mentioned previously, are of equal efficiency, combined with lower cost, due to

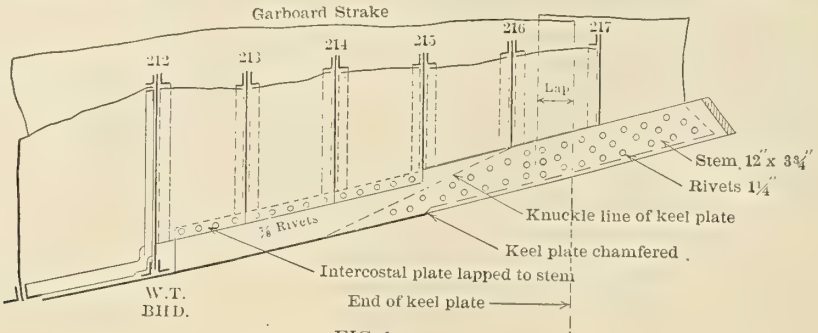


FIG. 1

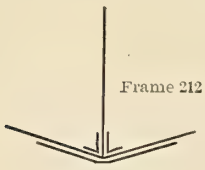


FIG. 2

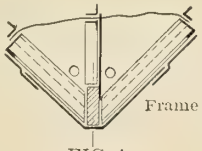


FIG. 4

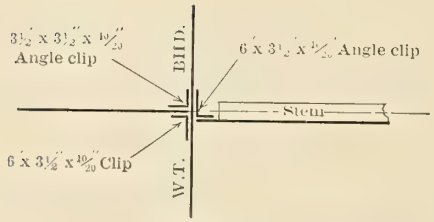


FIG. 3

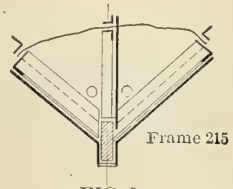


FIG. 5

Marine Engineering

METHOD OF SCARFING A BAR STEM TO PLATE KEEL.

the International Mercantile Marine Company, is to be the largest vessel in the world, marking a decided step toward the thousand-foot ocean liner that already is predicted. She was put into the water November 21, the vessel being released from the stocks by a hydraulic ram, and the launch being successfully accomplished in one minute. The dimensions of the *Baltic*, which in general plan is a sister to the *Celtic* or *Cedric* of the same line, are: Length, 725 feet 9 inches; beam, 75 feet; depth, 49 feet; gross tonnage, 24,000. She will have a cargo capacity of 28,000 tons, and her displacement at load draft will be about 40,000 tons.

Accommodations are provided for about 3,000 passengers and a crew of 355, and in all classes the arrangements are according to the most modern standards, showing an improvement over even the most recent White Star ships, which have been regarded as the finest type of ocean liner. The first-class smoke-room and library will be on the upper promenade deck and the staterooms on the two decks below. The second-class accommodations will be directly aft of the first, and the third still further aft and to a limited extent forward, staterooms accommodating two, three and four persons being a special feature of the latter class. The dining saloons will be especially commodious and comfortable, and all the bathrooms and sanitary appliances of the most approved design.

The decorations will be of the most striking and artistic kind. The dining saloon, extending the full width of the ship on the upper deck, will be perhaps the most magnificent on the Atlantic, the domed skylight being a particularly impressive feature of the decorative

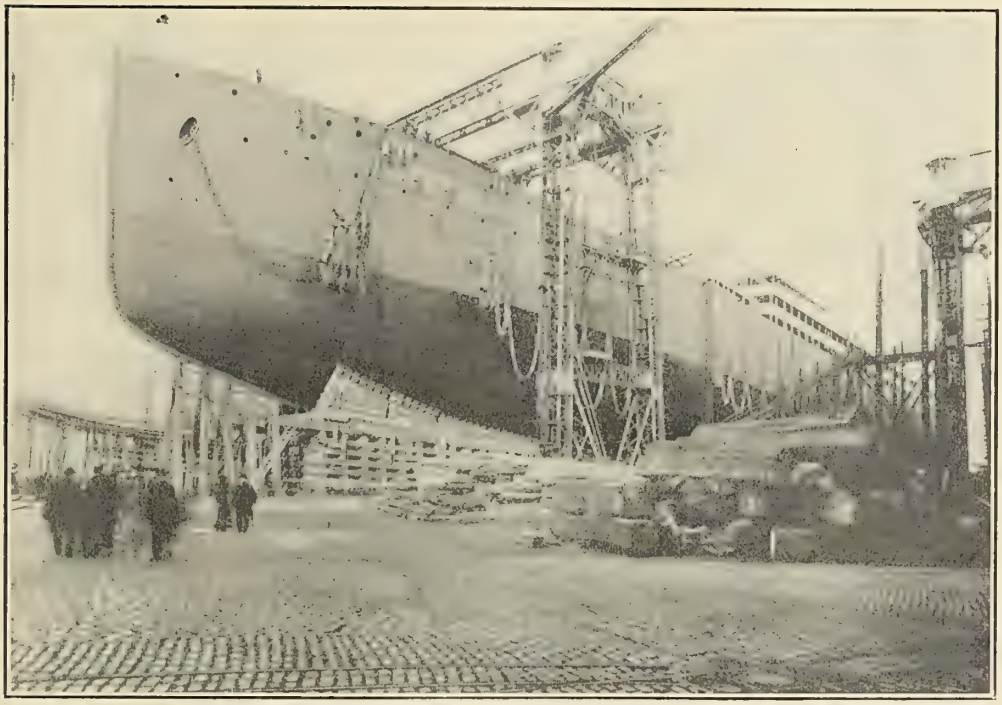
there being no special forging with the requisite molds and patterns; the cost and difficulty of obtaining good steel castings are grave sources of dissatisfaction in shipbuilding economy, rendering their use undesirable.

The only disadvantage worth naming is the fact that the entrance of the hull at the part shown by Fig. 1 cannot properly be termed fair, because of the knuckle line of the plating suddenly dropping from the top edge to the bottom edge of a 12-inch keel in the short distance of two frame spaces; but this has an adverse effect on the appearance to a very small extent; how much depends greatly on personal knowledge and opinion of the critic. K. D.

New Steamship Baltic.

The steamship *Baltic*, now fitting out at the Harland and Wolff yards, Belfast, for the White Star Line of

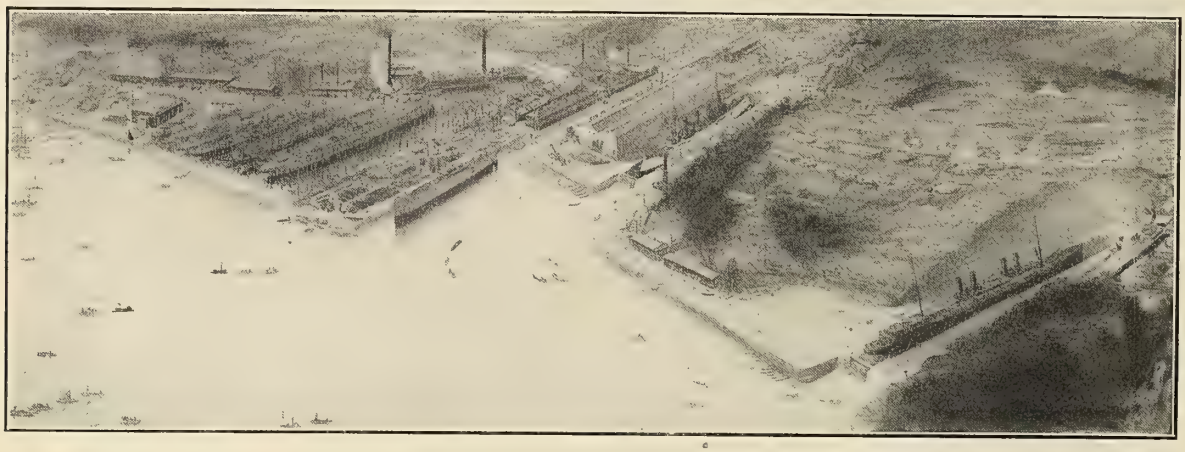
scheme. The first-class smoke-room and library are similarly handsome apartments, and the second-class public rooms are in corresponding taste. Besides the beef, and are provided with the most efficient machinery for loading and discharging cargo. Her engines will be of the quadruple expansion type, about 13,000 I. H. P.,



STEAMSHIP BALTIC, FOR THE WHITE STAR LINE, LAUNCHED FROM THE YARDS OF HARLAND AND WOLFF, BELFAST.

ordinary staterooms, the new vessel will have an unusual number of suites, and several single-berth staterooms will be provided. The heating and ventilating of the ship follow the most modern practice and are most complete in detail.

The *Baltic's* holds will include refrigerators for chilled built on the balance principle, to reduce vibration. A speed of 16 1-2 to 17 knots is required, while twin engines and twin screws reduce the danger of disabling accidents to the minimum. The ship will probably be ready for the summer service between New York and Liverpool.



BIRD'S-EYE VIEW OF THE MITSU BISHI

THE MITSU BISHI DOCKYARD AND ENGINE WORKS, NAGASAKI, JAPAN.

The Akunoura Engine Works were founded at Nagasaki, Japan, by the Shogun government about 1856. Dutch engineers were employed and necessary machines and gear for commencing the business were imported from Holland. In consequence of this it is often noticed that a few old hands in the works still use the Dutch terms for some of the machinery. The jetty on which now stands the sheer legs were constructed at that time by means of a clumsy diving bell of Dutch make, which implement still remains at a corner of the works, in memory of the pioneers. At first the works were only on a very small scale, for repairing small steamers owned by the Shogun. About ten years later they were handed over to the superintendency of the present Meiji government, by whom great improvements were made. A large dry-dock at Tategami, now called No. 1 Dock, was constructed, and the patent slip at Kosuge, then owned by a British merchant, was purchased, and the business becoming gradually established, a steamer named *Kosuge-Maru*, of 1,500 tons gross was built of wood, as a forerunner of the shipbuilding in this island empire.

In 1884 the ownership of the whole works was passed from the government to the present proprietors, the Mitsu Bishi Company, and three years later the first iron steamer, of about 205 tons gross, was built, followed by three steel steamers, each about 700 tons, and also a steel steamer of 1,592 tons.

The following is the list of the principal vessels built at this yard since 1898:

Ship's Name.	Gross Tonnage.	I. H. P.
T. S. S. Hitachi-Maru,	6,172	3,888
T. S. S. Awa-Maru,	6,309	4,112
S. S. Miyajima-Maru,	1,592	890
S. V. Tsukijima-Maru,	1,519	305
(With auxiliary engines.)		
S. S. Tategami-Maru,	2,691	1,774
S. S. Akunoura-Maru,	1,717	1,340
T. S. S. Tahung-Maru,	2,243	2,242
S. S. Yenoura-Maru,	645	436
T. S. S. Kaga-Maru,	6,301	5,411
T. S. S. Iyo-Maru,	6,319	5,106
S. S. Oura-Maru,	712	700
S. S. Wakamatsu-Maru,	2,774	2,279
T. S. S. Tachang-Maru,	2,711	2,495
S. P. Dredger "No. 2 Dokai-Maru,"	495	400
S. P. Dredger "No. 3 Dokai-Maru,"	495	400
S. S. Daiya-Maru,	2,795	2,366
Steam Yacht Hatsukaze,	80	220
T. S. S. Aki-Maru,	6,443	5,448
S. S. Chefoo-Maru,	1,933	1,565
S. S. Niigata-Maru,	2,183	1,577
S. S. Yeiko-Maru,	1,966	1,963
S. S. Nikko-Maru,	5,400	6,500

H. I. J. M. Ss three torpedo boats, one 120 tons, the other two each 82 tons in displacement, were built, the material being given by the government.

Besides these, many smaller crafts of various types between 200 and 300 tons and a large number of steam launches were built.

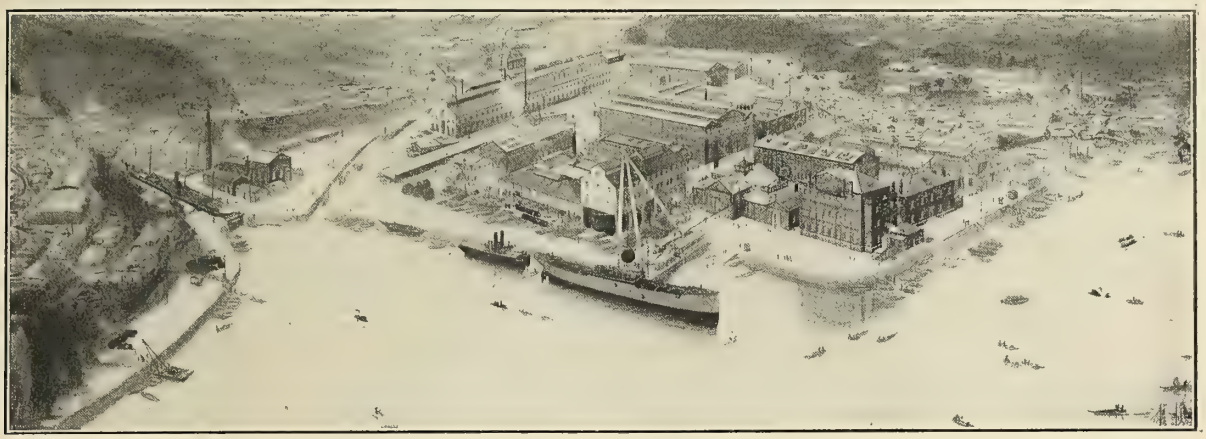
The works have of late been very much improved by extensions, new buildings being erected and large additions made to the machinery, all of the latest type, the premises covering at present about 80 acres.

The following will give a good indication of the capacity of the works: One pair of tripod steel shear legs of 100 tons capacity on the jetty for landing or shipping of heavy boilers and machinery, the depth of water under the shear legs being 25 feet.

BUILDINGS.

A machine shop has been lately built fitted with one 20-ton, one 15-ton, and two 5-ton overhead traveling cranes electrically driven; over 40 of the newest type of machines of various description, some of which deserve special mention, and include: a planing machine to plane 21 feet horizontally and 18 feet vertically; 54-inch center crank shaft lathe; 30-inch center gap lathe, the height of center in gap being 6 feet 6 inches; two lathes 22 inches centre shaft lathe, having a common center line to turn 67 feet in maximum length; one 5 1-2-inch spindle double universal horizontal drilling, tapping, boring, studding, and milling machine to move 10 feet vertically and 15 feet horizontally, and a cylinder boring machine to bore out cylinders up to 100 inches diameter.

The boiler shop has of late been extended and many machines added, including electric shell drilling machines, one 40-ton electric traveling crane, one 40-ton



DOCKYARDS AND ENGINE WORKS, NAGASAKI, JAPAN.

hydraulic crane, and also one 105-ton hydraulic riveting machine; also a plate roller which rolls a plate up to 2 inches thick by 11 feet 9 inches wide.

The blacksmith shop is furnished with eight steam hammers, ranging from 50 pounds to 7 tons, with sufficient hearths, furnaces, and cranes, etc., which enable the works to undertake any forgings up to 15 tons.

The foundry has lately been greatly extended and is capable of turning out iron casting of 50 tons, if necessary, in one casting. In the central building there are two electrically-driven overhead traveling cranes whose combined lift is 50 tons, and besides these five 3-ton swinging cranes in the wing.

The erecting shop is of ample size, fitted with overhead traveling cranes, one of these being 30 tons in capacity.

An electric shop is also installed with ample plant to execute electrical repairs, etc.

ELECTRIC POWER INSTALLATION.

Steam as a motive power has been superseded by electricity, which is now being used on a very extensive scale throughout the works, not only for lighting but also for driving machinery.

The Akunoura power house has been extended and equipped with two 25-Kw. Edison shunt dynamos, one 35-light Brush arc dynamo, and two new sets of 225-Kw. compound dynamos of the General Electric type, coupled direct to McIntosh-Seymour vertical cross-compound engines, have been lately added. At Tategami a new power house has been built, furnished with two 100-Kw. Seimen compound dynamos coupled direct to William's central valve compound double-crank engines, and one 25-Kw. shunt dynamo.

The Tategami shipyard, including joiner shop, saw mill, carpenter shop, galvanizing shop, machine shop, blacksmith shop, and molding loft, etc., has been greatly extended and improved, and is now capable of turning out ships of a gross tonnage of over 20,000 in one year. It has eight building berths ranging from 700 feet to 170 feet; all departments are well laid out with rails, turntables, portable cranes, etc.

Pneumatic tools have been tried on a small scale, as an experiment, and are to be installed at Tategami works generally.

DOCKS AND PATENT SLIP.

The works are equipped with two stone built dry-docks and one patent slip. Besides these, one very large dry-dock is in course of construction, which is now very nearly completed.

The following are the particulars of the docks and slip:

Name of Docks or Slip.	Length of Keel Blocks.	Breadth at Entrance		Depth of Water on Blocks at Ordinary Spring Tide.
		On Top.	On Bottom.	
No. I. Dock....	510 ft. 0 ins.	89 ft. 0 ins.	77 ft. 0 ins.	26 ft 6 ins.
No. II. Dock...	350 " 0 "	66 " 0 "	53 " 0 "	24 " 0 "
No. III. Dock..	714 " 0 "	96 " 7 "	88 " 7 "	34 " 6 "

(The No. III. Dock is in course of construction.)
Patent Slip.—Length of rail, 750 feet; width of rail, 30 feet. The slip is capable to take up ships up to 1,000 tons.

The company also own a salvage steamer of 712 tons and 12 knots speed specially built for the purpose, fitted with all the necessary pumps and gear of the most powerful description; a large number of experienced workmen and divers are always ready at short notice to undertake salvage operations.

SCHOOL, HOSPITAL, AND BENEFIT ASSOCIATIONS.

The works' school, which has been opened four years, has an accommodation for five classes totaling 250 boys each year, allowing 50 new candidates to enter and 50 graduating, but at present it is attended by 218 boys divided into five classes. This institution is free to the general public through the generosity of the owners of the works.

The yard has its own hospital for wounded to accommodate about 50 patients, in which men are treated at the expense of the company. The company has also its own water supply for the daily use of the works and for fire service, the reservoirs containing about 15,000 tons of water. The number of workmen employed is from 5,000 to 5,600 daily on pay sheets.

For the benefit of the workmen there is an institution called the Shokko Kyugo Ho, enforced since the end of the year 1897 with satisfactory results. This institution is based upon the principle of an assurance system,

each employee contributing a certain proportion of his wages on each pay day to which the employer contributes a like amount. The benefit accruing to the workman varies from 50 to 2,500 yen (a yen is equivalent to about 50 cents), according to class and rate of wages, and this is applied to the families of those who have died of wounds received on duty, to those incapaciated through injury received at work, and to those who, retiring from old age or other reasons, are entitled to receive pensions from this fund according to their grade of work.

To encourage thriftness amongst the workmen a savings-bank system was formed and put in force on October 1, 1902. The system requires, first of all, that one "kuchi," or a deposit of one yen, shall be made by each depositor on each pay day, and this amount is kept in a separate account, and when the amount of the principal and interest shall have reached 300 yen the savings for one "kuchi" is expired, and 50 yen extra to each 300 yen will be given as an encouraging subsidy or bonus.

In conclusion it should be stated that the capacity of the works is ample to undertake any repairs or to dock any vessel afloat; for this purpose a large supply of materials of every description is always kept in stock. Further improvements and extensions are to be carried out both at Akunoura and the Tategami, which, on completion, will still further add to the present capacity.

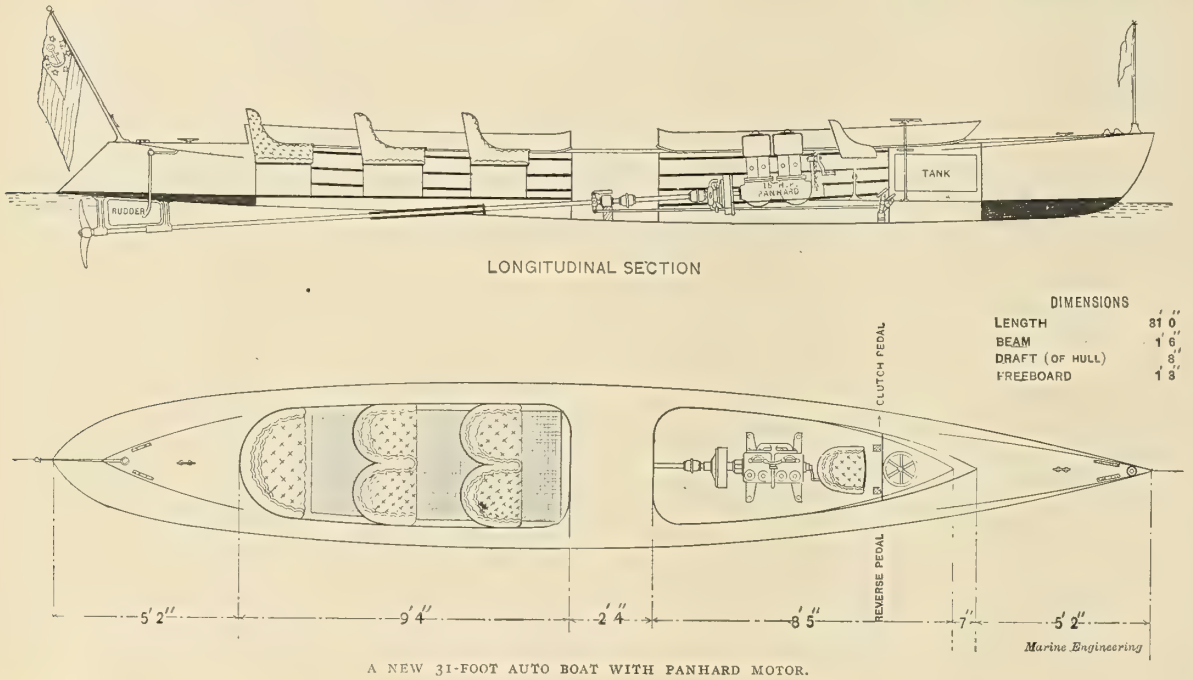
On another page of this issue will be found a description and illustrations of one of the newest steamships now under construction at this famous yard.

Naval Hospital.—Secretary Moody has written the House naval committee urging that Congress appropriate funds for the construction of a naval hospital at Yokohama, Japan.

Construction and Possibilities of the Auto Boat.

BY HENRY R. SUTPHEN.

The requirements of the typical auto boat, which is now being developed in this country, have necessitated a marked advance in hull construction. Last year several boats of this type were built at the works with which I am connected, both from designs prepared by outside naval architects and by the drawing-room force of the boat yard. Among the boats built from outside designs was the tender of the cup defender *Reliance,* which was one of the first light auto boats turned out in this country. The details of construction of these boats seemed at the time they were brought out to be the very lightest in weight of material that it was possible to build, but the success which they attained and the strength that they proved to have in actual service warranted the designers in going a step further, so that the boats to be turned out by this yard this season will have still lighter hulls; in fact, the lightest that it is probable have ever been built in this country.



A NEW 31-FOOT AUTO BOAT WITH PANHARD MOTOR.

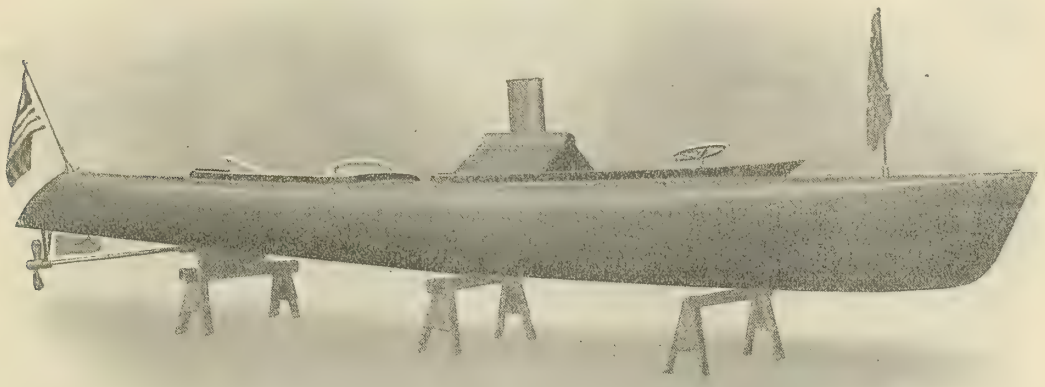
Among these new boats is one to the order of the Panhard Company, herewith illustrated.

To reduce weight of these shells, very light selected oak frames with very light plank keel are used, and in the smaller boats longitudinal frames with double planking are adopted. In the Panhard boat the finished thickness of the double planking is less than 5-16 of an inch. This hull, without machinery, weighs only 471 pounds, while the total weight of the boat equipped with an 18-22 horsepower engine and tanks is 1,060 pounds, which figures out that 1 horsepower is obtained for every 48 pounds of loaded weight. In the best automobile practice of to-day the ratio of horsepower to loaded weight is 1 to 85.

The Panhard engine which is installed in this boat was received a few weeks ago from Paris. The engine

is a complete unit in itself, being equipped with the builders' latest devices for vaporizing the gasoline in the Krebs carburettor; the latest improvements for lifting the gasoline to the engine by means of compressed air, and with the latest electrical-sparking apparatus, which enables the engine to be started up without the use of electric batteries, for the current for sparking the gas is derived upon the turning of the crank from the magneto. This is a decided advantage for boat work, as it eliminates all exposed electric wiring and complications with the electric batteries, which are hard to keep in order on a boat.

The muffler of the engine is on top of the cylinders, and a neat metal hood covers the top of the engine, and on top of this a small smokestack is placed to carry off the gases, which is plainly shown in the picture and which makes the boat look very unique.



31-FOOT AUTO BOAT WITH PANHARD MOTOR.

From past experience I believe the fastest auto boats, especially those of small size, are those lightest built and the ones equipped with foreign-built high-grade engines. There is no doubt but that the boat which is to win the race will be the one that has the lightest shell, with, of course, fair lines and a light, reliable motor. The light hulls, above mentioned, are built in the same proportion and embody the same requirements in their particular class as the foreign-made automobile engines hold to-day in their class. In other words, the slow-speed American marine engine that has been in use for so many years is not suitable for the light shell of the typical auto boat. American manufacturers are beginning to realize this point, and doubtless we will see great improvements made in the construction and details of the American marine engine used for this class of racing boat. In my opinion, the auto boat is not to be simply a fad, but will fill certain demands that boat builders have as yet been unable to meet. This demand is for a boat to be used on small bodies of water where long-distance cruising is not possible, but where the exhilaration of high-speed racing may be enjoyed.

Steamship Dakota.—On February 7 the *Dakota* was launched from the yard of the Eastern Steamship Company, Groton, Conn. She is a sister ship to the *Minnesota,* launched in April last, and which was fully described in Marine Engineering for May, 1903. The principal dimensions of the *Dakota* are: Length over all, 630 feet, between perpendiculars, 608 feet; beam, molded, 73 feet; draft, 33 feet; displacement, load, 33,000 tons. It is stated that the *Minnesota* will be in condition for her sea trial next July and the *Dakota* in September.

Cruiser Charleston.—On January 22 the protected cruiser *Charleston* was launched at the yards of the Newport News Shipbuilding and Dry Dock Company. The event was very successful and the ceremonies were attended by many state and government officials. The principal dimensions of the ship are as follows: Length on water line, 424 feet; extreme breadth, 66 feet; mean normal draft, 22 feet 6 inches; corresponding displacement, 9,684 tons. The ship will be propelled at an estimated contract speed of 22 knots by two sets of four-cylinder, triple-expansion engines, with cylinders 36, 59.5, 69 and 69 inches diameter by 45 inches stroke. The calculated total maximum horsepower is to be 21,000. Twelve Babcock and Wilcox boilers, which will supply the steam, have a grate surface of 1,400 square feet, and a heating surface of 64,000 square feet. The *Charleston* is one of three sister ships authorized by act of Congress June 7, 1900, the other two being the *Milwaukee,* building at the Union Iron Works, and the *St. Louis* at the yard of Neafie and Levy Ship and Engine Building Company. She will have a main battery of fourteen 6-inch R. F. guns, for it is not intended that ships of this class should engage in the battel line. Her secondary battery consists of eighteen 3-inch R. F., and thirty-eight smaller pieces. She is fitted with a protective deck 3 inches thick on the slopes and 2 inches on the sides, but the only other protection on the water line is afforded by corn pith belt.

OFFICIAL TRIAL AND DESCRIPTION OF THE IMPERIAL OTTOMAN CRUISER MEDJIDIA.

In the year 1900 Ahmed Pasha, chief engineer of the Ottoman navy, came to this country for the purpose of examining our system of naval construction. After surveying the various shipyards, their facilities and methods, and the results in vessels built, he proposed, on behalf of the sultan, to contract with the William Cramp and Sons Ship and Engine Building Company for the production of a twenty-two knot protected cruiser. Plans and specifications were prepared and submitted to the Ottoman Admiralty, which, after thorough examination and a few minor changes to meet special requirements, were approved, and the contract for the construction of such a vessel signed. The contract included hull, engines, armor, guns, and all fittings necessary to make the ship complete and ready for service at sea.

NEW AMERICAN-BUILT IMPERIAL OTTOMAN CRUISER MEDJIDIA, AT ANCHOR IN THE DELAWARE.

[Photograph by J. W. Dawson,]

This vessel is of the protected cruiser type, the engines, boilers, and magazines being placed under an armored deck. The principal hull dimensions are as follows: Length over all, 335 feet 11 inches; beam molded, 42 feet; depth molded to upper deck, 30 feet; draft, normal mean, 16 feet 1 inch; corresponding displacement, 3,432 tons. Other dimensions will be found on page 126.

GENERAL ARRANGEMENT.

In the hold forward of the boiler room are trimming tank, wet provisions, store room, chain locker, magazines, and handling room. Coal is stored in compartments forward of boiler room and at sides. Aft of the engine room are engine stores and fresh-water tank.

On the forward platform deck are wet provisions and magazines. On the aft platform deck are dynamo room, evaporator room, magazines, steering gear, and general stores.

On the protective deck are rooms for lamps, sails, crew space, boatswain's and carpenter's stores, cold storage, coal bunkers, fan room, bread room, ordnance and electrical stores, dry provisions, armory, paymaster's, warrant officers', junior officers', ward room, and captain's stores.

On the berth deck are captain's and officers' quarters, ward room, the junior and warrant officers' quarters, pantries, bath rooms, water closets, etc., crew spaces, wash rooms and water closets, crew sick bay, dispensary, drying room, ice machine, work shop, windlass engine, and torpedo tubes.

On the upper deck are the armament and galleys.

ARMAMENT.

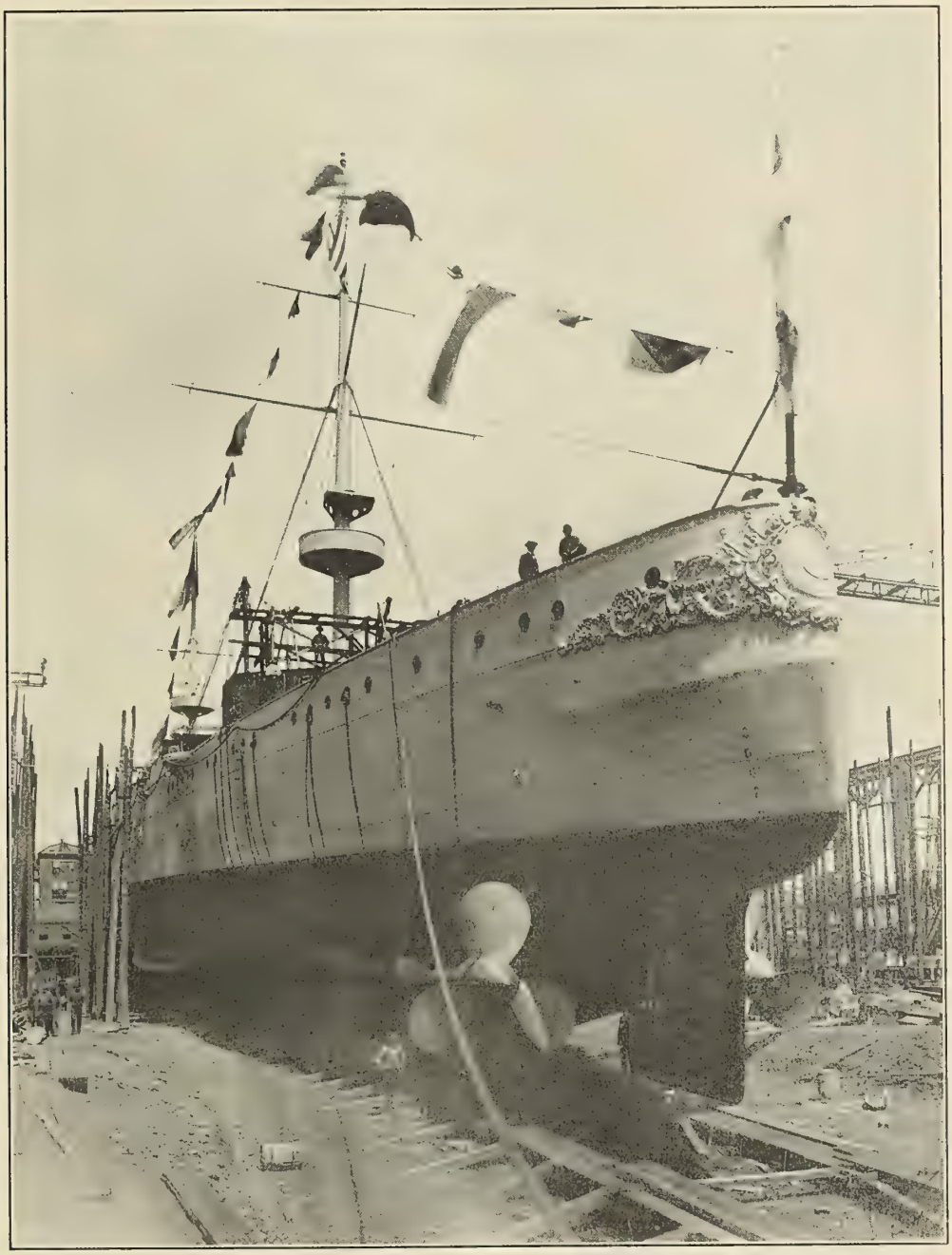
There is a protective deck extending fore and aft, the central portion rising above the load line and sloping at the sides to 4 feet below the load line. The maximum thickness of armor on the slopes is 4 inches. The ship is otherwise unarmored except that the conning position is armored with 4-inch plates.

The battery consists of the following guns: two 6-inch, 45 calibre; eight 4.7, 50 calibre, rapid firing; six 3-pounders; six 1-pounders, semi-automatic, 50 calibre, rapid firing; one 3-inch field gun; and two broadside 14 inches above-water Whitehead torpedo tubes.

As will be noted, the battery is entirely of rapid-firing guns, and for the displacement of the vessel is very powerful. The forward and after pair of 4.7-inch guns fire directly ahead and astern respectively and have each

a total arc of fire of 150 degrees. The balance of the 4.7-inch guns have a broadside train of 120 degrees each. The 3- and 1-pounders are so mounted on the bridges, hammock berthings, and military masts as to give the

the hoops ordinarily terminate, and are in accordance with the most modern United States guns. The guns were built by the Bethlehem Steel Company and are entirely the product of American manufacture; in fact,



OTTOMAN CRUISER MEDJIDIA, JUST BEFORE LAUNCHING, IN THE YARD OF THE WILLIAM CRAMP AND SONS' SHIP AND ENGINE BUILDING COMPANY.

best train and protection to the ship against torpedo-boat attack.

The guns are so arranged as to have one 6-inch and two 4.7-inch ahead, and the same astern. The broadside fire consists of two 6-inch and four 4.7-inch guns. All the guns are of the latest type and the 6-inch and 4.7-inch are hooped to the muzzle, thus providing against any sudden diminution of the strength of the guns where

the whole vessel throughout, in material, outfit, and construction is of American production and workmanship.

The battery is supplied with ammunition by eight electrical hoists of the endless-chain type.

DRAINAGE SYSTEM.

The main drainage system consists of two 7-inch

pipes extending from forward boiler room to the engine room, where they are connected to the main condenser circulating pump.

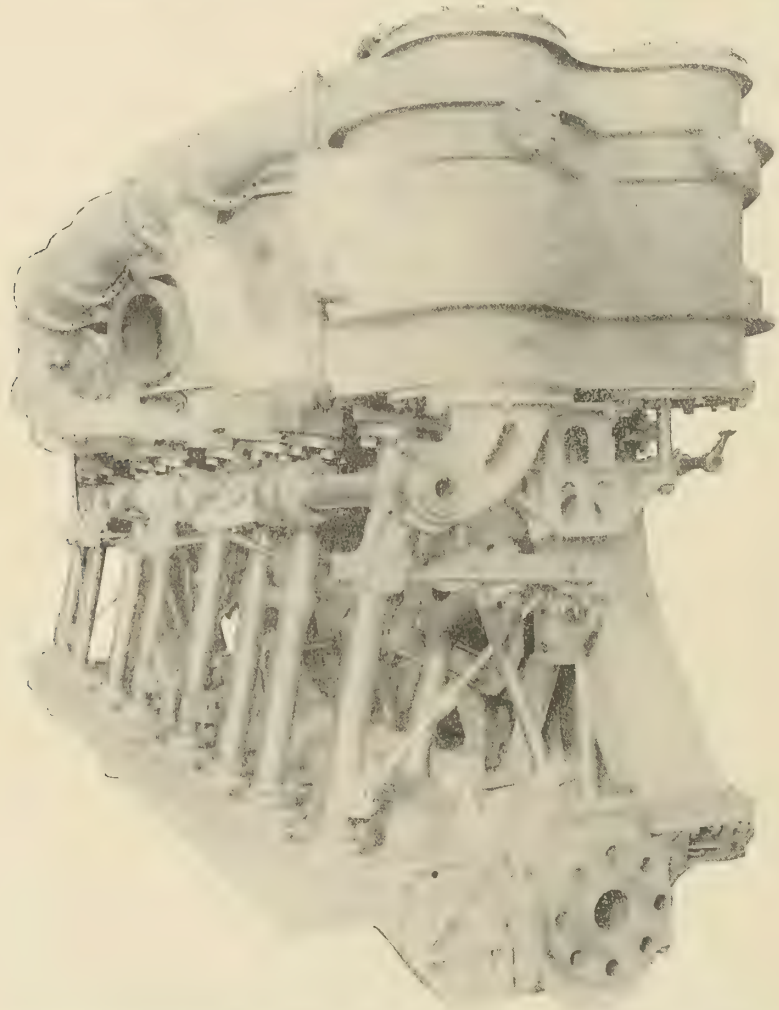
There is a secondary drainage system with 5-inch connections to the machinery space and the compartments forward and abaft of them. Each compartment of the double bottom has an independent suction.

The water above the protective deck is emptied by portable hand pumps, with flexible hose, or by scuppers.

in each engine room. The reversing engine is of the steam-floating lever pattern. The turning engine is a double-inverted engine working through worm gearing.

The principal dimensions of engines will be found in the table.

There are two main condensers. The shells are oval in shape, made of composition. Each condenser has 3,078 tubes 5-8 inch outside diameter and No. 17 B. W. G., giving a cooling surface of 7,110 square feet each.



4-CYLINDER, TRIPLE-EXPANSION ENGINE FOR THE IMPERIAL OTTOMAN CRUISER MEDJIDIA.

MACHINERY.

The propelling engines are right and left, placed in separate water-tight compartments abreast of each other. They are of the vertical four-cylinder, direct-acting, triple-expansion type, with high-pressure cylinders forward and the two low-pressures aft. The main valves are of the piston type with Stephenson link motion. There is one double-ported valve for the high-pressure cylinder and two single-ported valves for the intermediate- and each low-pressure cylinder.

The framing consists of a cast-steel housing at the back and forged-steel columns at the front. The pistons are of cast steel and conical in shape. All cylinders are fitted with working liners. The intermediate- and low-pressure cylinders are jacketed. The bed plates are of cast steel of "I" section. A steam separator is fitted

There are two main centrifugal circulating pumps with 14-inch inlet and outlet. Each pump has an engine 6 inches diameter by 6 inches stroke.

There are also the following steam pumps:

2	Air pumps.	10 by 23½ by 15 ins.
2	Main feed pumps,	12 by 7 by 12 ins.
2	Auxiliary feed pumps,	12 by 7 by 12 ins.
2	Hot well pumps,	7½ by 8½ by 10 ins.
2	Water service pumps,	5½ by 4¾ by 5 ins.
2	Crank pit pumps,	5¼ by 4¾ by 5 ins.
2	Fire and bilge pumps,	9 by 5¼ by 10 ins.

Besides these pumps there are the oil pumps, etc.

In the port engine room there is one Wheeler auxiliary condenser with 500 square feet cooling surface and combined air and circulating pump 7 1-2 by 9 by 9 by 10 inches.

In the passage between the after fire rooms is one feed-water heater made of steel shell plates and composition heads containing 806 square feet of heating surface. There are two feed tanks each of 1,000 gallons capacity, fitted with sponges for filtering.

The propellers are made of Parsons manganese bronze; the starboard propeller is right hand and the port left hand. The propellers are of the built-up type, each having three blades.

There are sixteen Niclausse water-tube boilers, designed for a working steam pressure of 275 pounds. The boilers are arranged in three groups in four fire rooms, two single and two double. There are 238 elements in all. Each element has four evaporating tubes 3 1-4 inches outside diameter and twenty-nine tubes 1 9-16 inches outside diameter. All are seamless drawn tubes. Boilers are fitted with automatic feed valves and automatically closing fire doors and balanced ash-pit doors. The total grate surface is 775 square feet and the total heating surface is 28,857 square feet. There are three smoke pipes with a combined area of 151.42 square feet.

Forced draft on the closed stoke-hold system is provided by eight blowers 5 feet diameter, the four forward fans being 14 inches and the after four are 18 inches wide at the tip. As space in the fire room was limited a new departure was made in the arrangement of these blowers, which proved entirely successful. The blowers were located in rooms over the protective deck, two in each room. The rooms communicate with the living quarters and with the open air through hatches, the blowers drawing air through these sources and delivering it through openings in the deck to the stoke hold below.

Fresh air for ventilation is supplied under pressure by eleven electrically-driven fans, while the exhaust is by natural means.

There are two evaporators with a capacity of 7,500 gallons of feed water every twenty-four hours, and one distiller with a capacity of 7,000 gallons of drinking water per twenty-four hours. The plant is fitted with the necessary pumps, filters, etc.

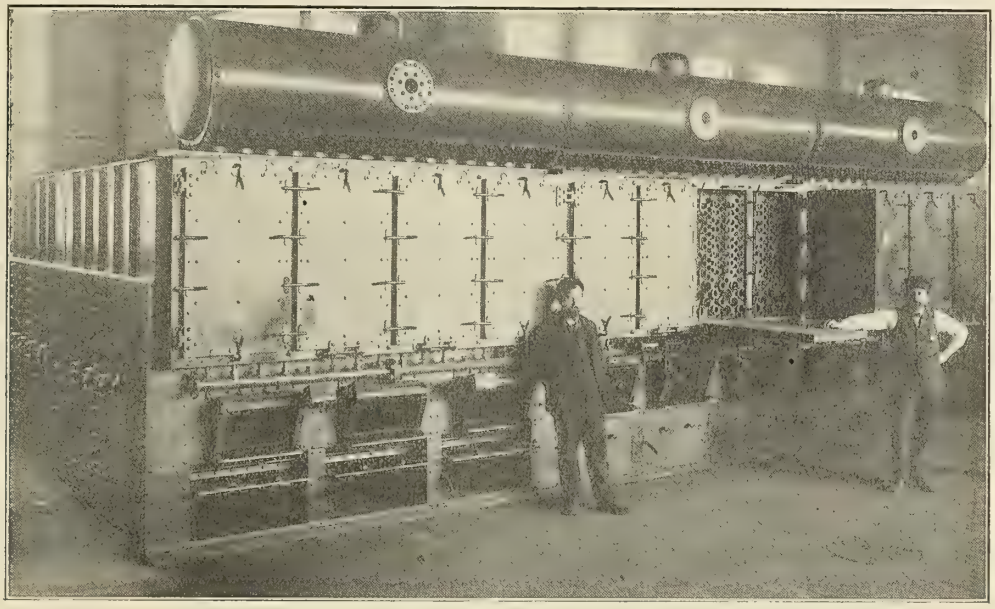
The refrigerating equipment consists of one Allen dense-air ice machine capable of producing one ton of ice per twenty-four hours. A workshop is provided which is fitted with an emery grinder, shaper, drill press, and a screw-cutting lathe, all driven by an electric motor.

There are two 50-Kw. dynamos fitted with all the necessary details, including four 24-inch search lights.

The vessel is also fitted with telegraphs, ash hoists, steering engine, windlass, boats, etc.

OFFICIAL TRIAL.

The official trials of the *Medjidia* were held on the Chesapeake bay, the standardizing runs being over the Barren island course. The first three double standardizing runs were made on December 17, 1903, and the last two on the 19th of December, 1903. Each standardizing run consisted of one run up and back over the measured mile. On each run, time, revolutions, indicator cards, etc., were taken. These conditions and results will be found on page 126. From the data obtained on these runs a speed curve was constructed, from which was determined the speed made during the six-hour endurance trial, which followed immediately after the last standardizing run. On this trial the revolution counter readings were taken every fifteen minutes, the other engine and boiler conditions every half hour. A summary of these results will be found in the data card on the next page.



NICLAUSSE BOILERS ON THE MEDJIDIA, ERECTED IN THE SHOP.

The mean draft for the trial was 16 feet 6 inches, with a displacement of 3,540 tons.

It will be noted that during the speed trials of December 19 the *Medjidia* maintained an average speed of 22.29 knots per hour over the measured mile, thus exceeding her contract speed by .29 of a knot. The run home from the trial course was made in moderately bad weather, when the vessel proved herself to be a most staunch and easy sea boat.

During the preparation of the working plans and de-

STANDARDIZING TRIAL OF THE IMPERIAL OTTOMAN CRUISER MEDJIDIA.

Barren Island Course. December 17-19, 1903.

	First Double Run.		Second Double Run.		Third Double Run.		Fourth Double Run.		Fifth Double Run.	
	1st Leg.	2d Leg.	1st Leg.	2d Leg.	1st Leg.	2d Leg.	1st Leg.	2d Leg.	1st Leg.	2d Leg.
Duration of run, minutes and seconds	4-37	5-25	3-51	4-17	3-22	3-29	2-51	2-46	2-42	2-41
Speed, knots	12 996	11.07	15.584	14.008	17.822	17.225	21.05	21.69	22.22	21.36
Mean speed during double run.	12.136 knots.		14.796 knots.		17.523 knots.		21.37 knots.		22.29 knots.	
Mean indicated horsepower	1420		2706		4716		9071		10347	
Mean revolutions for double run, per minute	101.1		124.23		151.05		183 93		191.05	
Apparent slip of propeller, per cent	9.9		9.9		12.1		12.1		11.8	
Steam pressure, at engines	257	244	230	225	228	269	248	235	237	240

MARINE ENGINEERING DATA CARD. **MARCH, 1904.**

NAME—Medjidia. NATIONALITY—Turkish. TYPE—Protected Cruiser.
LAUNCHED—1903. BUILDER—Cramp's Shipyard. OWNER—Turkey.

Length over all.....335 ft. 11 in.
" between perpendiculars.....330 " 0 "
Beam, molded.....42 " 0 "
Depth, molded to upper deck.....30 " 0 "
Normal displacement.....3,432 tons
Full load " .....3,757 "
Mean normal draft.....16 ft. 1 in.
Tons per inch of displacement.....22.3
Ratio, length to beam.....7.85
Block coef.....535
Midship section coef 925
Load water line " 675
Number of frames.....82
Distance between frames.....4 ft.
Number of watertight compartments.....108
Engines.....twin-screw, four-cyl., triple
Cylinder diam....30, 47, 52, and 52 in.
Stroke .....30 "
Piston rods, diam., H.P. & M P., 6 1-4 in.; L.P., 5 1-4 in.
Connecting rods, upper end, diam., H.P. & M.P., 5 1-2 in.; L.P., 4 1-2 in.
Connecting rods, lower end, diam., H.P. & M P., 6 1-2 in.; L.P., 5 1-2 in.
Connecting rod, length, center to center....5 ft.
Crank shaft, diam..13 3-4 in. outside, 7 in. inside
" pins, " ..14 1-2 " " 7 " "
Thrust shaft, " .....13 3 4 in.
" collars, cast shaft, number.....13
Line shafting, diam.....13 in.
Stern tube and propeller shaft, diam....13 3-4 "
Main steam pipe, diam.....11 1 2 "
Cooling surface, two condensers.....14,220 sq. ft.
Propellers, material .....Manganese bronze
Boilers, type.....Niclausse water-tube
Number.....16
Elements, number.....238
Grate surface, total.....775 sq. ft.
Heating " " .....28,857 " "
Working pressure.....225 lbs.

TRIAL DATA **MARINE ENGINEERING DATA CARD.** **MARCH, 1904.**

NAME—Medjidia. NATIONALITY—Turkish. TYPE—Protected cruiser.
LAUNCHED—1903. BUILDER—Cramps' Shipyard. OWNER—Turkey.

Time: Length of trial .....6 hours
Steam Pressure: Boilers.....224.5 pounds
Engine, port, 228; starb.....225 "
H. P. receiver, port, 179; starb ....173 "
M. P. " " 63; " .... 62 "
L. P. " " 13; " .... 9.8 "
Vacuum, port, 26; starb.....26 ins.
R. P. M. from counter, port, 179.6; starb 176.2
Double stroke air pump, " 29; " 26
Rev. circulating " " 231; " 205
Temperature: Injectors, port, 39°; starb. 39.7° F.
Discharge, port, 107°; starb .....109° F.
Feed .....102° F.
Air Pressure, forward fire room.....1-2 in.
Forward middle " " .....1-4 "
Aft " " " ...1-2 in.
" fire room .....3-8 "
Speed of ship in knots from curve.....20.65
Slip from curve.....12.3

Horsepower, port, H. P..... ... 1,500
" " M. P.....1,472
" " F. L. P..... 810
" " A. L. P..... 796
Total.....4,5-8
Horsepower, starb., H. P.....1,513
" " M. P.....1,514
" " F. L. P 758
" " A. L. P.. 696
Total..... 4,471
I. H. P., both main engines.....9,049
Draft, mean. ..... 16 ft. 6 ins.
Displacement, tons.....3 540
H. S. in use..... 28,857.5 sq ft.
G. S. " " ..... 775 " "
I. H. P. ÷ G. S.....11 6
H. S. ÷ I. H. P..... 3.18
Admiralty coef 226

signs, also the construction of the vessel, machinery, and arrangement, the sultan has been represented by Lieutenant-Commander Sabri Bey, of the engineer corps, and Lieutenant Ali Bey, of the construction corps. Both of these gentlemen have been highly educated in all that pertains to the building of war vessels and their machinery. They have been most faithful in the performance of their duties and have maintained the respect and admiration of all with whom they have come in contact.

Doubtless this vessel, the product of American workmanship, with her remarkably graceful appearance, will prove a most valuable addition to the Ottoman Navy when she is delivered to the authorities at Constantinople.

RACING MOTOR BOAT STANDARD, RUNNING AT FULL SPEED IN NEW YORK BAY.

Racing Motor Boat Standard.

During the spring of 1903 the United States Long Distance Automobile Company desired competitive bids on a 60-foot hull for a high-speed launch in which to install one of its new 110-horsepower gasoline motors and test its capabilities. A number of designers were asked to submit plans for the proposed boat, which was to fulfill the following requirements:

1. That the hull should be of extreme lightness without sacrificing the strength consistent with the estimated power of the engine.

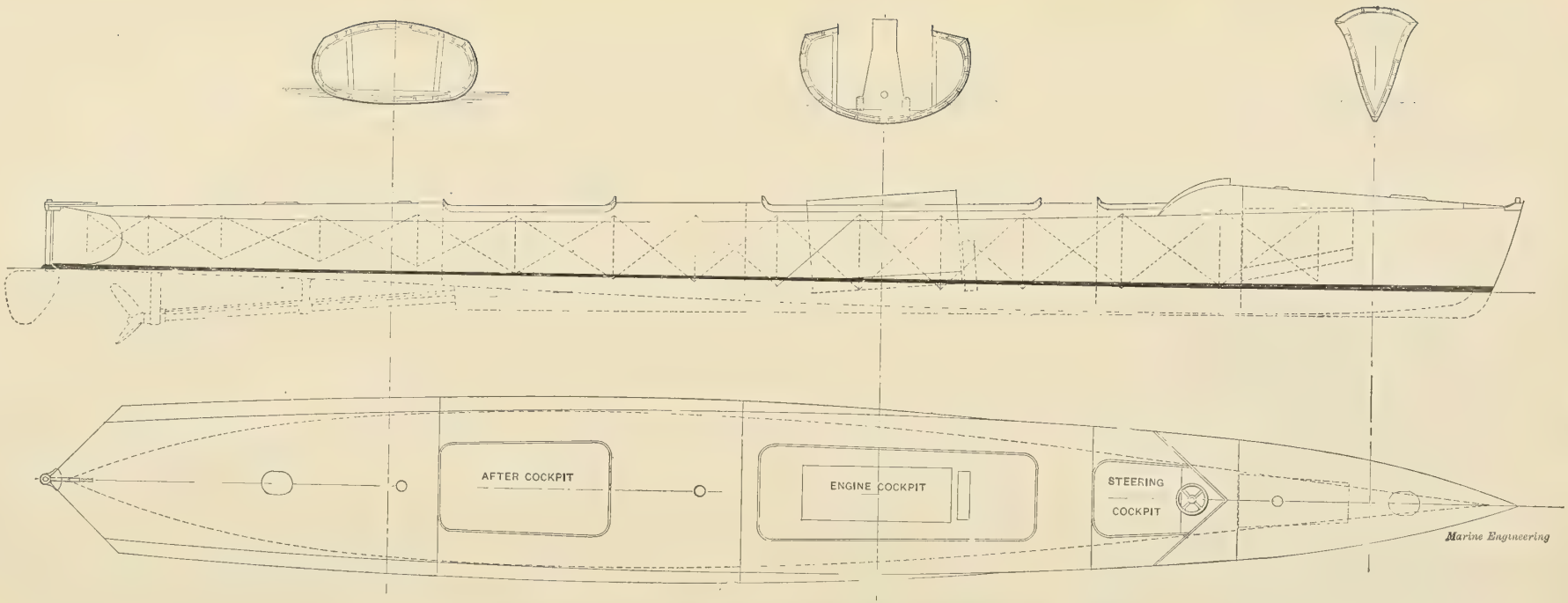
2. That the hull should be made of such form as to obtain the greatest possible speed on the given length, and be perfectly able and seaworthy in the ordinary run of weather about New York harbor, lower bay, and sound.

After consideration of all the plans submitted, the contract was awarded to the Marine Construction and Dry Dock Company, who designed and built the boat at its works, Mariner's Harbor, Staten island. The dimensions of the launch are: Length over all, 60 feet; length on load water line, 58 feet; extreme beam, 7 feet 6 inches.

A departure was made from the usual method of construction, and the novel and scientific scheme adopted, for which a patent has been applied, afforded great saving of weight in every detail. The planking is of single-thickness, Honduras mahogany, finished to 3-16 inch. The fore and aft plank edges are also on continuous longitudinals of Oregon pine and fastened to them with brass screws closely spaced and let in flange. As shown in the sketch, a system of double framing is used. The longitudinals are notched for the outer frame, and the inner frame, longitudinal, and outer frame are through riveted, making a very light but substantial arrangement. The inner frame is in one length and forms the lower member of the deck beam, the outer member running from side to side only. The longitudinal strength of the boat is obtained from two truss girders running from end to end in the wings and consisting of upper and lower continuous longitudinals, wooden compression struts, and galvanized wire diagonals set up very tight. These girders were designed to take off any hogging or sagging strains which might occur under the most extreme conditions. Care was taken to have the weight of the engine well distributed fore and aft, and this was effected by means of deep floors under the engine bearings, these floors resting on the longitudinals and lower members to the girders.

Special mention should be made of the engine which has many novel features. The system of forged columns and diagonal bracing gives a general appearance of similarity to a marine engine; it is of the four-cycle type with six cylinders, each 8 inches diameter and 10 inches stroke. The most interesting feature is the ingenious method of manipulating the engine by means of compressed air, and thus doing away with the usual reversing clutch. A pump is attached to the after end of the shaft and compresses air into a reservoir to the pressure of 150 pounds. In addition to the regular set of inlet and exhaust valves fitted on each cylinder for controlling the gas, on two of the cylinders a second set of valves is employed for the compressed air. Each set of valves is operated by a cam shaft, and each shaft has two sets of cams, one for going ahead and the other for reversing. The operations of starting, stopping, and reversing are controlled by means of horizontal levers worked in a notched quadrant similar to steam-engine brackets.

The *Standard* developed great speed on its numerous trials, and was successfully raced during the summer against many of the fastest yachts and steamers in the vicinity of New York. The most remarkable of its performances was the easy defeat of the steamer *Monmouth* in an informal race from Atlantic Highlands to the Battery, most of the trip being accomplished in a moderate seaway, which did not seem in any way to affect the speed of the launch. In this and other trials in rough and broken water the boat proved dry and



PLAN AND SECTIONS SHOWING THE CONSTRUCTION OF THE RACING MOTOR BOAT STANDARD.

seaworthy, with easy motions, no vibrations, twisting or evidences of any straining. The highest speed developed by the *Standard* was about 23 miles, but this was with the experimental propellers, which did not give satisfactory results. It is expected that with a suitable wheel the speed will be considerably better next season.

Liquid Fuel.—The American-Hawaiian Company's steamship *Nebraskan* left San Francisco on January 20 for New York direct with a supply of fuel oil in her bunkers for use under the boilers for the entire trip. This is the first steamer to make that voyage of 13,000 miles using oil alone for fuel. The capacity of the oil tanks was 10,000 barrels.

Scout Ships Fitted With Turbines.—The Navy department has submitted a proposition to the Westinghouse, General Electric, and Allis-Chalmers companies for a complete installation of steam turbines for 3,700-ton scout ships, included in this year's naval program. The latter company has just entered the turbine field, and is prepared to undertake the installation of turbines for marine propulsion and electric generation. The first plans of the Navy were for scout ships of 1,200 tons, but upon learning that vessels of this class are being built for the German Navy, to be propelled by turbines and to be of very much greater speed, the department changed its plans and increased the size of the scouts to 3,700 tons each. It is stated that a speed of 26 knots is considered, which will require the installation to be of at least 20,000 horsepower. In figuring up the space to be occupied by the turbines, it was found that while the motors themselves occupy less room than reciprocating engines, owing to the high vacuum necessary to maintain, the auxiliaries must be considerably larger.

Extension of Navigation Laws.—It is to be hoped that at the present session Congress will pass the Frye bill for the extension of the navigation laws to the Philippines, whereby none but ships of American registry can partake in the coast commerce of the islands or in the commerce between the United States and those islands. Small opposition has been encountered from certain cordage manufacturers, but the bulk of testimony given before the Senate Committee on the Philippines was in favor of the passage of this bill.

NEW AUSTRALIAN LINER NIKKO-MARU.

The *Nikko-Maru,* which was launched from the Tategami shipyard of Mitsu Bishi Dockyard and Engine Works on October 23, 1903, is a steel single-screw steamer of 5,600 tons gross, built especially for the Nippon Yusen Kaisha's Australian service. The dimensions are 420 feet long between perpendiculars, 50 feet beam, 30 1-2 feet depth. The ship is very elaborately fitted for the accommodation of 60 first-class passengers, 28 second class, 24 intermediate, and 108 steerage passengers. She has a straight stem, an elliptical stern, a poop, bridge, and forecastle, one funnel, and two pole masts. She is divided into eight water-tight compartments and is constructed with double bottom right, forward, and aft. There are two complete decks, upper and main. The bridge deck, which extends for a length of 175 feet, is sheltered by the shade deck and reserved for the first-class passenger's promenade, while the poop is for the second class. At the forward end of the shade deck are the captain's and other officers' cabins, Chadburn's steering, docking, and engine-room telegraphs, Lord Kelvin's compass, and other modern nautical appliances. The navigating bridge is over the chart room.

The first saloon, social hall, and smoking room in the ship are on the bridge deck. The chief decorative feature of the saloon is a square-trunk skylight which rises 21 feet from the saloon floor to the height of navigating bridge, and is 10 feet square. The upper part of the skylight is of rich stained glass. In the forward end of the saloon there are two large wireless cloisonne panels worked in wall; one panel representing wild ducks in water and the other wild ducks in flight. These are by Mr. Namikawa, a member of the Imperial household artisans and famous for his wireless cloisonne ware. The saloon itself is panelled in white oak with moderate carvings and is well lighted from the side by Messrs. J. Stone and Company's new patent large rectangular sliding windows. The revolving chairs with eccentric motion have stuffed and cane seats, so that they may be reversed to suit the climate. The sofa seats along both sides of the saloon are stuffed and covered with olive-green morocco leather, and the floor is covered with rich axminster carpet. Furniture, such as tables and sideboards, are all of white oak; these with the general finish of the saloon are of inter-Anglo-Japanese nouveau design.

The saloon is large enough to seat 80 persons to table at one time and as a whole forms a very luxurious and comfortable saloon. Aft of the saloon is the grand stairway, panelled also in white oak and similar finish to the saloon, giving access to the first-class cabins on the upper deck. It is lighted overhead by a large skylight glazed with stained glass, as well as from the sides. The center panel is a large art silk velvet, with a magnificent picture of a water fall in black and white, prepared by Mr. Iida of Kyoto.

Situated abaft the grand stairway is the saloon pantry, well equipped with steam table, sinks, water boiler, filter, etc., all complete. The floors of saloon entrance and saloon pantry are covered with india-rubber mats. The social hall is at the forward end of the saloon; the wall is lined with white oak and finished similarly to the saloon. There are three silk panels with classic pictures of Mount Arashi (a mountain near Kyoto famous for its cherry blossoms), woven in silk goblin fabric. The social hall is furnished with piano, writing desks, and a number of easy and occasional chairs. It will not be amiss to add here that this social hall was fitted up at the Osaka exhibition this year and was used by their Imperial Majesties the Emperor and Empress as a retiring room during their visit. The furniture is in peacock blue with classic bamboo and flora-paullonia design in silk damask. All these fabrics are by Mr. Kawashima, a well-known silk weaver and a member of Imperial houshold artisans, to the builder's design. The floor is covered with rich axminster carpet.

Further aft on the bridge deck is the first-class smoking room, with walls carried up above the level of the shade deck, thus giving a greater head room. Light is admitted through large stained-glass skylight on top as well as by large rectangular windows at the sides. The walls are panelled in stained oak and adorned with an embroidery work of three "Do Not" monkeys from the painting specially executed by Mr. Takeda Seiho, a well-known Kyoto artist. The furniture includes comfortable settees, revolving chairs, and whist tables. Settees and chairs are covered with olive-green morocco leather. The floor is covered with india-rubber tiles made and supplied by Gorham Rubber Company, U. S. A. This room has a bar fitted with all modern requisites.

The accommodations for the first-class passengers, engineers, surgeon, purser, and other officers, and surgery, barber shop, galleys, etc., are in the bridge on the upper deck. There are twenty-eight first-class state rooms on the upper deck and two on the bridge deck; each room is fitted up for two passengers and is provided with iron folding beds, Broadfoot's fold-up lavatory, electric bells, and all those little accessories and conveniences which add so much to the comfort of passengers.

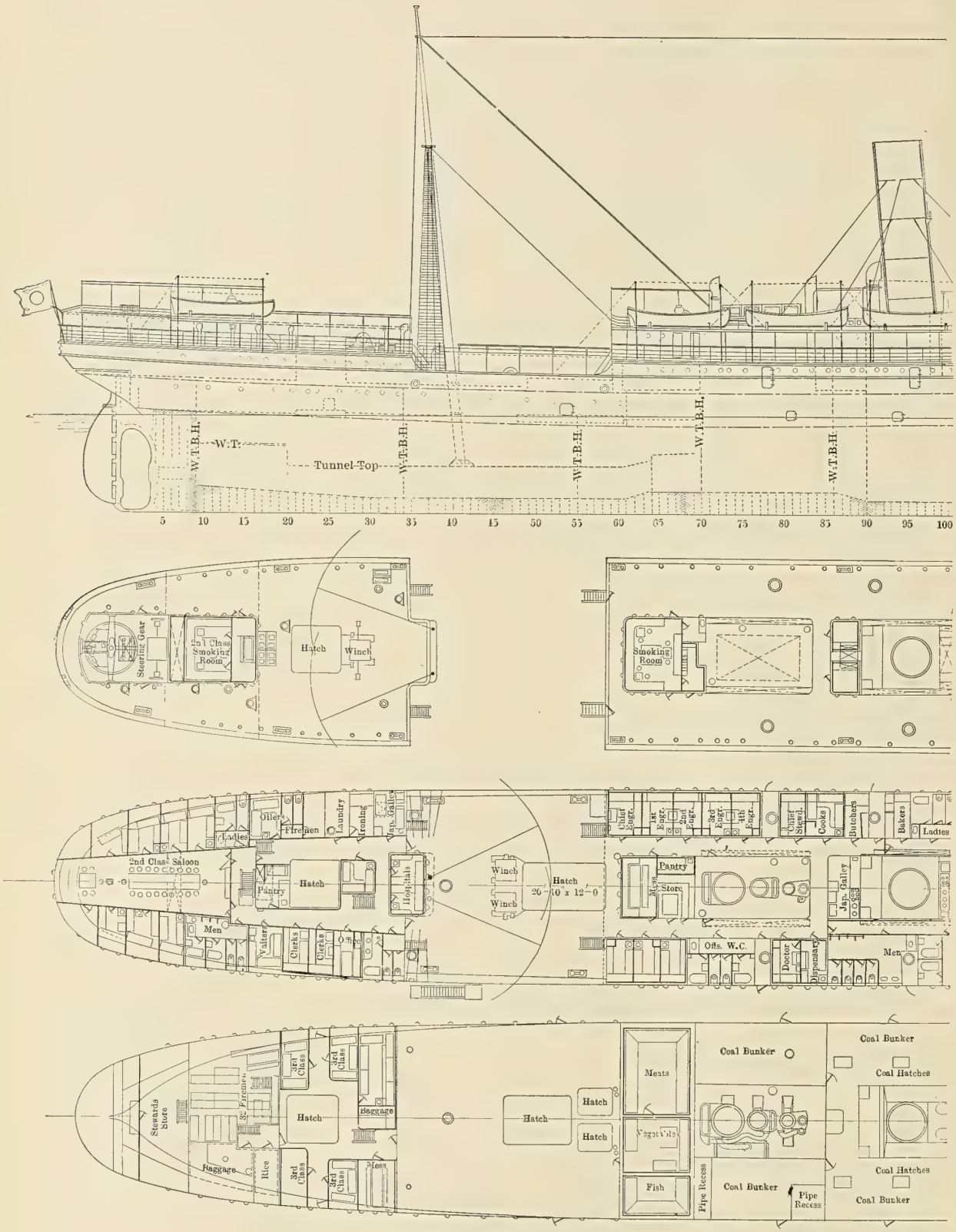
A poop 95 feet long forms the promenade. Upon it is built a steel house containing the steering engine, an entrance hall to the saloon below, and the smoking room which is furnished with piano, sofa seats, chairs, and tables. The floor is covered with india-rubber mats.

The furniture in the dining saloon includes a handsome sideboard, large dining table, small family table, and twenty-five revolving chairs. Both the saloon and smoking room are panelled in stained oak and of inter-Anglo-Japanese nouveau design. Seats and chairs are covered with mock-morone morocco leather, and the floor is laid with brussels carpet. Along each side of the saloon there are state rooms, provided with iron folding beds, fold-up lavatory, etc., all finished in general respect equal to the first-class state rooms of an ordinary transpacific passenger steamer.

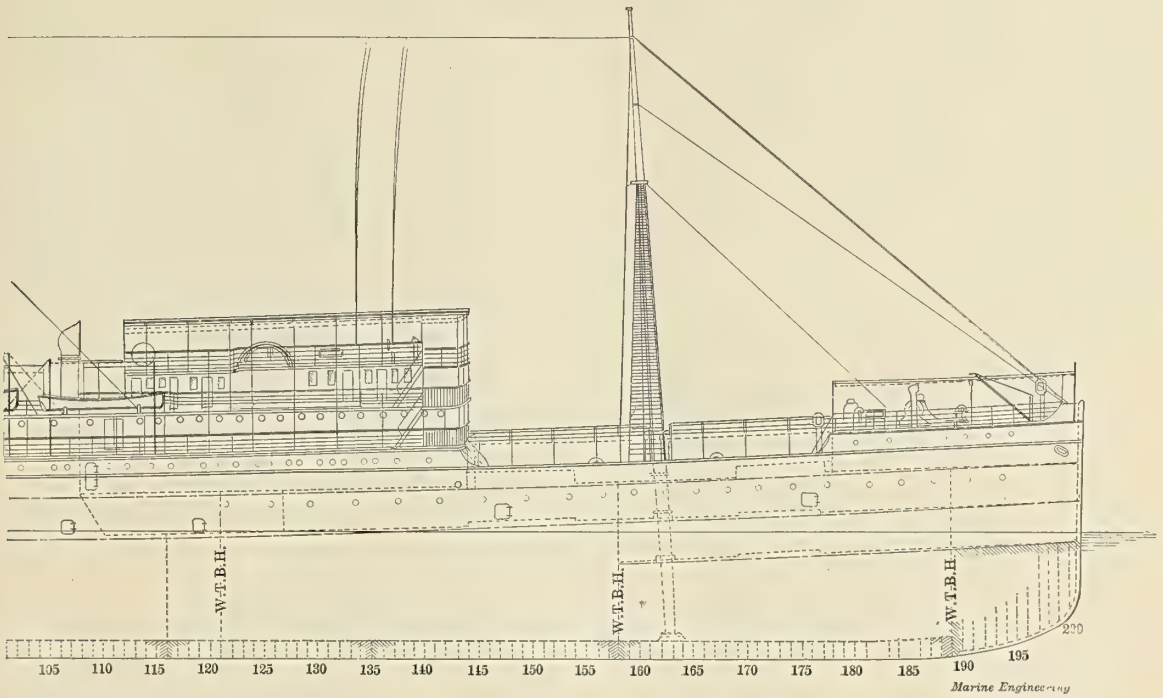
The after part of the main deck is given up to intermediate passengers and fore part to steerage passengers. Hoskin's patent portable iron beds are fitted in these quarters. The sanitary arrangements are very complete, the baths are of enamelled fire clay placed in large airy rooms with salt and fresh-water supply, douche, etc.

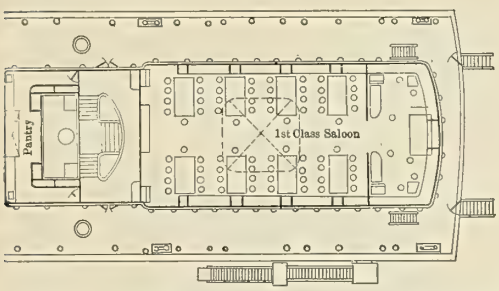
The vessel is provided with a sufficient number of boats to carry everybody on board when she has her full complement; and all boats are fitted with Mills' patent disengaging gear.

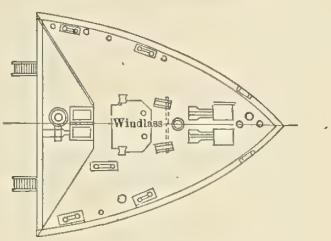
The deck machinery consists of six powerful steam

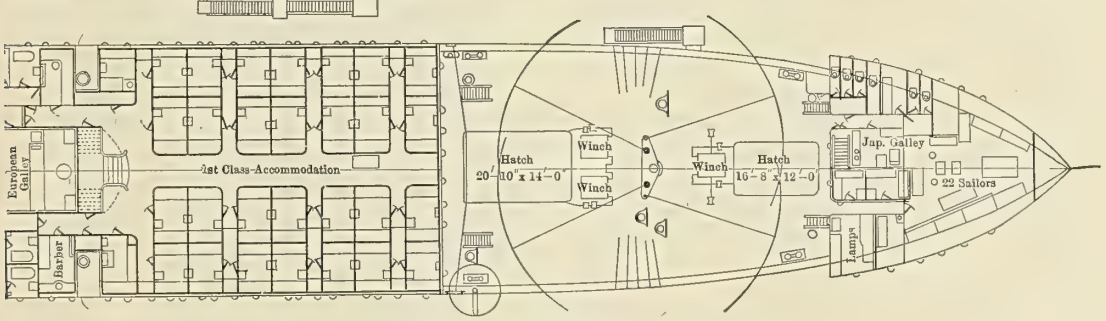


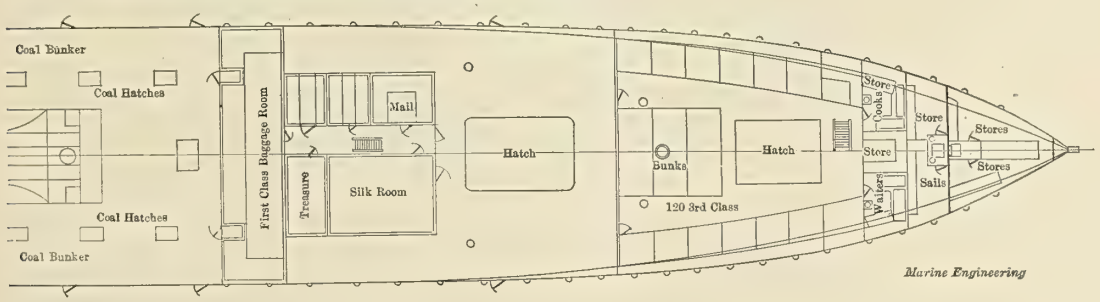
INBOARD, PROFILE, AND DECK PLANS OF THE NEW PACIFIC LINER NIKKO-MARU











FOR THE AUSTRALIAN SERVICE OF THE NIPPON YUSEN KAISHA.

winches, steam steering gear, made by Messrs. Caldwell and Company, with Hastie's patent spring brake on steering circle, hand-screw steering gear, and Napier's patent vertical steam windlasses, etc.

The *Nikko* is lighted throughout by electricity and affords a striking instance of the extent and completeness of the installations which are now fitted in first-class passenger steamers. The total number of lamps is over 500, making the total candle power slightly above 10,000, and to this must be added ten cargo lamps each of 250 candle power. The installation is on the double-wire system and the current is supplied at a tension of 100 volts by one compound engine, driving direct-compound wound dynamo having drum-wound armature, of Clark, Chapman and Company's make and provided with dynamo in duplicate. From an artistic point of view the installation must be pronounced extremely pleasing to the eye. In saloons, social hall, smoking rooms and state rooms the fittings are mostly silver plate, well harmonizing with the general design and coloring. The engine and boiler rooms and quarters for the sailors, etc., are amply lighted. The installation includes the signal lamps at the mast heads, sides, and stern of the vessel, and in addition a large number of electric fans for the ventilation of the passenger accommodations and holds. A special feature of the vessel is the heating and cooling arrangement by Stewart's thermo-tank system. The plant consists of four large electric fans arranged to draw the fresh air through a ventilator and to discharge it through a nest of steam pipes with ample heating surface. The warmed air is carried all forward and aft of the different apartments by means of galvanized sheet-iron trunks with openings, so that the warm air may be obtained in any room and apartment. The same apparatus is so arranged as may be used for cooling the air by leading a current of brine through the coil in thermo-tanks. The *Nikko* is the second vessel flying the Japanese flag fitted with this plant, the first being *Kumano-Maru,* also in the Australian service.

The vessel is fitted with a large Hall refrigerating plant capable of making 1,500 pounds of ice per day or of cooling spacious refrigerating chamber. Cooking ranges, grills, electric ironing apparatus, hot press, vegetable steamer, etc., all of the latest type, further add to her complete equipment as a modern passenger steamer.

The engines of the vessel consist of one set of triple-expansion engines having cylinders of 31, 51, and 85 inches in diameter by 54 inches stroke. Steam exhausts into a separate cylindrical condenser with 6,414 square feet of cooling surface with a centrifugal circulating pump driven by independent engines. An Edwards' air pump, two feed, and two bilge pumps are driven by main engines. The valve gear is of the ordinary double-bar link motion type and like the whole of the working parts is provided with very large wearing surfaces. Special care has been taken to render every part as accessible as possible and the adjustments easy of execution. There are two single-ended boilers each of 15 feet 6 inches diameter by 10 feet 6 inches long, and two double-ended boilers each of 15 feet 6 inches diameter by 18 feet long, containing a total of 14,840 square feet of heating surface. The furnaces, Morrison's patent, are 3 feet 10 inches in diameter, and the grate surface is 465 square feet. See's ash ejectors are fitted in each stoke hold with a powerful pump. Weir feed pumps and heater, and a Morrison evaporator are very conveniently placed. Besides these pumps and those worked by the main engines there are the usual ballast, auxiliary feed, salt, and fresh-water pumps, all conveniently arranged.

The *Nikko,* on her trial, which will take place very shortly, is expected to attain a speed of 17 knots, and on her completion, which will be sometime toward the end of the year, the builders have good reason to believe that this ship will be the finest and best of all the Japanese-Australian liners.

Nippon Yusen Kaisha, or the Japan Mail Steamship Company, Limited, has a fleet which now consists of 77 steamers of a gross tonnage of 242,163 tons and 17,128 nominal horsepower. Besides these there are three vessels now building including the *Nikko-Maru* above described. These vessels were until recently run under government subsidy, and now, since the war has been declared, are operated by the government for transports, etc. In the year just closed, the growth of the freight and passenger business handled by this company has increased very decidedly on all lines except the line

MARINE ENGINEERING DATA CARD. MARCH, 1904.

NAME—Nikko Maru. NATIONALITY—Japanese. TYPE—Ocean steamer.

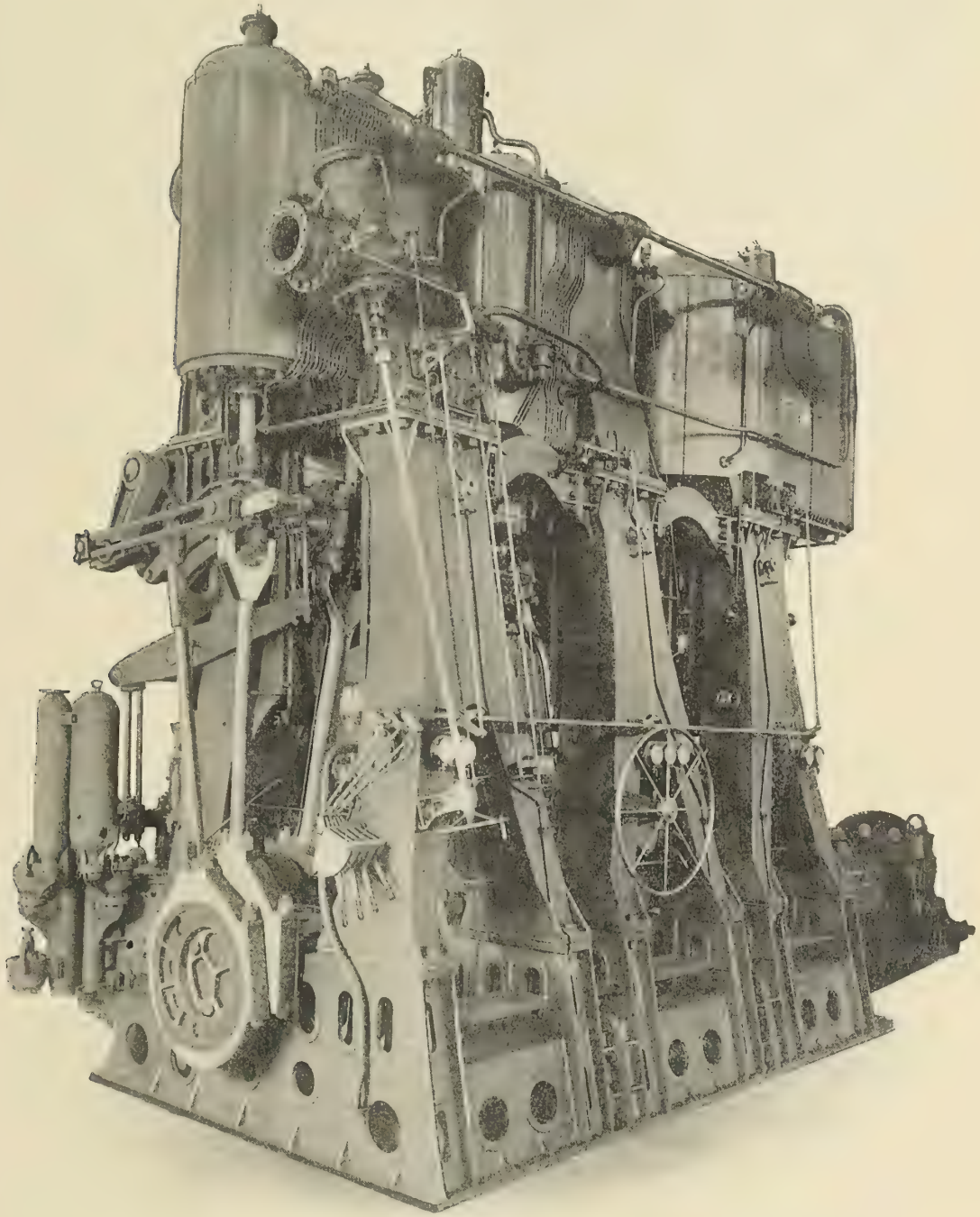
LAUNCHED—1903. BUILDER—Mitsu Bishi D. and E. Works. OWNER—Nippon Yusen Kaisha.

Length over all	434 ft. 0 ins.
" between perps	420 " 0 "
Breadth, molded	50 " 0 "
Depth, "	30 " 6 "
Height between decks	7 " 11 "
Gross tonnage	5,600 tons
Engines:	single, triple
Diameter cylinders	31, 51, and 85 ins.
Stroke	54 ins.
Valves, Piston on H. P., slide on I. P. and L. P.	

Boilers: Number	2 single-end; 2 double-end
Pressure	185 pounds
Diameter	15 ft. 6 ins.
Length	10 ft. 6 ins.; 18 " 0 "
Number of furnaces	18
H. S. total	14,840 sq. ft.
G. S. "	465 " "
I. H. P. on trial, estimated	6,500
Speed on " "	17 knots
H. S. ÷ I. H. P.	2.28
I. H. P ÷ G. S.	13.98
H. S. ÷ G. S.	31.91

running to Vladivostock. It operates lines from Japan to Chinese and Korean ports, to England, Australia, and America, as well as in the coast service among the islands of Japan.

upon a permanent war footing. The changes suggested are: First, alteration in the organization of Navy yards, to result in increasing the power and responsibility. Second, the consolidation of the operators in



TRIPLE-EXPANSION ENGINE OF THE NIKKO-MARU, BUILT BY THE MITSU BISHI DOCKYARD AND ENGINE WORKS, NAGASAKI, JAPAN.

Secretary Moody's Report.—The chief point of interest in the annual report of Mr. Moody, Secretary of the Navy, is a strong recommendation that the entire organization of the Navy be considered by Congress, and that such changes be made that the Navy shall be kept

the department. Third, the creation of a general staff which shall be responsible for the efficiency of the vessels afloat and the personnel of the Navy, to act as military adviser of the Secretary, and to collect and digest military information.

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Notice to Advertisers.

Changes to be made in copy, or in orders for advertisements, must be in our hands not later than the 15th of the month, to insure the carrying out of such instructions in the issue of the month following.

IN our issue for February we made in these columns some remarks regarding the value of technical education for the engineer, and the qualities which such a course of instruction might be expected to enhance. The further question still remains as to the efficiency with which the technical colleges are doing the work which may be thus expected of them.

The engineer, it should be remembered, stands as the mediator between the energies of nature and the needs of modern civilization. His primary function is to transform such energies from the non-available form, and to use them in the fulfilment of the manifold demands of the industrial world. It follows that the education of the engineer must necessarily have a twofold aspect; that which relates first to the fundamental transformations of energy, and second to its use in detail for the needs of modern industry. The former must be fundamentally scientific; the latter operative, economic, industrial and practical.

If any general criticism can be made on the tendencies of engineering education during the past 20 years, or during the period of its present existence, it may be said that the practical and economic aspects have been somewhat neglected in comparison with the scientific and theoretical. There has been, perhaps, some justification for this in the belief that such aspects might be better acquired by experience than in the class room or laboratory. With the industrial tendencies of modern times, the keenness of competition and the advance of the economic to the front rank as a controlling feature in all industrial operations, the increasing importance of the practical side of the engineer's activity, can no longer be doubted. It becomes therefore nothing less than the plain duty of every engineering school to give not only such fundamental and theoretical training as shall familiarize the student with energy in its various forms, and with the means available for its transformation and adaptation to specified uses, but also to give him such fundamental and organizing principles regarding the economic uses of energy and its application to the needs of civilization, that his keenest enthusiastic attention will be directed to observations along practical and industrial lines.

Having in view the general facts above noted, it seems to follow that the typical engineer of the immediate future will be to an increasing extent a man of affairs, a man with some capacity and training in the administration and conduct of business and industrial enterprises, a man fully alive to the economical and practical aspects of his field of work; a man who is not only capable of transforming and using energy for the ends of industry, but a man who is capable of producing, with a given investment of energy, the largest practicable output of useful product; a man not alone capable of doing things, but of doing them in the most efficient manner. In fact, there are now awaiting men of such large capabilities, positions of wide responsibility and influence, and such men must necessarily enter into the world's work as a larger factor than the man who deals with a single aspect of his profession, necessary as the latter may be. It cannot be expected that every man will reach such positions of wide influence and responsibility, but as they are open to the engineer of proper capacity and training, the engineering college should surely take cognizance of such fact, and strive to give to the world men qualified for these positions.

The situation in brief is this. We have, on the one hand, the field of engineering industry,

and on the other the technical college occupied in the training of men for lives of activity and usefulness in this field. Are we sure that the instruction given, having in view both subject matter and mode of presentation, is the very best possible in its adaptation to the demands of the field of activity for which it is intended as a training? It is very sure that while the principles of engineering are unchanging, the practice of the art has during the past few years undergone most radical and important developments. Have the developments in technical education kept pace with these developments? We may be permitted to doubt it, and to urge that the one great need of technical education at the present day is a closer contact and more accurate adjustment with the field of engineering practice. We may say otherwise that the aim of the technical college should be to make its education more *practical* in quality, implying by this term not necessarily more handicraft skill, but rather a more carefully studied adaptation of its instruction to the present and immediately prospective demands in the field of practical engineering work.

Our suggestion to the colleges in brief is, then, a more careful study of the actual field of engineering practice, with a view of bringing about a more perfect adjustment between the demands in such field and their courses of instruction, both in subject matter and mode of presentation. The technical colleges have unquestionably played an important part in the development of our modern industrial position, but they have hardly yet measured up to their full possibilities of usefulness, and with a closer and more perfect understanding and adjustment between the colleges on the one hand, and those who employ their output on the other, a step forward might be taken toward the more complete fulfilment of the opportunities of the technical colege as a present factor in the world's industrial work.

ALL eyes are turned with absorbing interest now to the far east to follow the events of the naval struggle between Japan and Russia. At the beginning of the war the fighting fleet of Japan, exluding obsolete ships, consisted of thirty-three ships with a total displacement of 208,240 tons, while the fleet of Russia in the Pacific waters numbered thirty-one battleships and cruisers, with an aggregate displacement of a little over 200,000 tons. The Japanese fleet is composed of six 18-knot battleships averaging about 14,000 tons each; eight armored first-class cruisers of 9,300 tons each; eight second-class cruisers of 4,500 tons each; one 7,200-ton coast defense ship; eight third-class cruisers averaging 2,870 tons, and one gunboat. In comparison with this, Russia's Pacific fleet is made up of eight first-class battleships of about 12,000 tons each; four armored cruisers of 11,400 tons each; six second-class protected cruisers with an average displacement of 6,500 tons; five third-class cruisers ranging from 1,500 to 3,000 tons displacement, and seven gunboats. Besides these ships, each navy has a fleet of new high-speed torpedo boats and destroyers.

While in numbers the fleets about equal each other, the advantage lies with Japan, presumably for several reasons. In the first place, she has a homogeneous fleet of fighting ships. Her six English-built battleships are much alike, and six of her armored cruisers closely resemble each other, and represent the highest types of vessels afloat. The two smaller armored cruisers are described elsewhere in this number. Again, Japan is fighting in home waters, with an unlimited supply of coal near at hand, and is near her dock-yards; Russia has but a limited coal pile which can only be replenished from across the sea, and but partially-equipped yards at Vladivostok and Port Arthur, which are inadequate to maintain the fleet at the point of highest efficiency even in times of peace.

At last it is possible to form some adequate idea of the value of the torpedo boat. By a most daring and well-planned attack, Japan succeeded in disabling several of Russia's finest ships at the very outset of hostilities. In engagements immediately following at Port Arthur and Chemulpo several other Russian ships were damaged, or destroyed; thus the balance of sea power has been most assuredly placed with Japan. The Japanese naval officers and men come from a seafaring race and are, it is stated, fighting with unbounded enthusiasm with all the training of the recent China-Japan war. The Russian ships are commanded by men of great intelligence and undaunted courage, but the crews are made up, for the most part, of an inferior grade of men from the peasantry unaccustomed to sea or war.

Two conclusions may already be drawn, namely, the value of the torpedo boat, and the necessity of a fleet of fast scout ships for keeping in touch with the ships of the enemy.

OLD SCOTCH'S REVERIE.

BY C. A. M'ALLISTER, U. S. R. C. S.

"Old Scotch" was one of a battery of four modern steel boilers that generated the steam to run a 4,500-ton steamship engaged in the freight and passenger business on the Atlantic coast. Officially he was known as No. 1 boiler, from his position in the ship, being on the forward starboard side of the fire-room. Then, too, he was constructed about a month before any of his associates. From his priority of birth and his official position, he assumed the leadership of his brothers and became the spokesman of the generating branch of the machines assembled on that vessel. Realizing his importance, he was not at all backward in expressing his opinions in a general conversation among the members of that particular colony of metallic workmen, nor of chiding his brethren for dereliction of duty if such procedure became necessary.

Occasionally during the night, when everything would be quiet, he would muse over his past life and grumble about what he considered to be the hard lot of boilers in general. One night, shortly after the steamer had started out on a homeward bound trip, and Old Scotch was feeling quite satisfied with himself and everything else in general, he soliloquized as follows:

"Well, I think when I get back to New York this time I will have completed my 300th round trip. The company ought to give me a present of some kind or other, as I have not only furnished my share of the steam to turn that grouchy old Triple* back there in the engine room, but I have also kept these three youngsters in here with me going at full blast and made each of them do his share of the work. Further than that, I haven't cost the owners a cent for repairs, outside of a few dollars' worth of grate bars, furnace door linings, firebricks and such other knick-knacks that any well behaving steam generator is bound to use up in his daily toil.

"I have had lots of chances to kick over the traces and do myself damage, and some of these fine days, if this fire-room crowd doesn't do the right thing by me, I'll show them that I can act mean and perhaps give them as much trouble as that cranky old main engine. I am not so young as I used to be, and I need a little better attention than I have been getting. I will do my part all right, but when we get in port and they start in to clean me up, I expect these men to do it in a first-class manner.

"This coal they have been feeding me on lately isn't the best I ever tasted by any means. I heard the chief engineer say that the company bought it for a half dollar a ton less than the usual kind I have been getting. If they expect me to furnish as much steam with this sooty, clinkery old stuff as I did with that fine grade of coal, I'll simply fool them.

"Bah! it makes me disgusted to think of how my tubes and flues are getting stopped up with the soot from this stuff. Some of the time I can scarcely get my breath. If the old chief hadn't issued that order to blow out my tubes every other watch, I know that I would simply suffocate. I don't like that blowing-out business much either, but it is better than choking to death.

"That water tender by the name of Rourke knows how to clean tubes all right, but the other two fellows are not onto their jobs. They open my connection doors and take as much time connecting up the steam hose as if they were going to sprinkle a lawn. Every once in a while they let the firemen and coal passers indulge in a jawing match about who will clean the wing nest of my tubes, while all the time they have all three connection doors swung up and the cold air striking me on the front tube sheet enough to make my very tubes chatter. None of that business goes with Rourke. He has one nest of my tubes assigned to each man, and the hose all connected up ready for business before he allows them to raise a door. They then clean one nest at a time and do it in mighty short order, too, or that water tender will know the reason why.

"These engineers in charge of this ship don't seem to realize that we boilers, even if we are built of steel, need quite as much attention and care as a human being to get the best results from us. I often hear these firemen and coal passers kick like mules about the grub, as they call it, if it is not properly cooked or of the right sort. If they only stopped to think a bit, they would find that the quality of the coal they feed us on is just as essential to our good health as the food which they put into the stomachs is to theirs. We can't exactly growl, but we can soon show by the work we do that we don't thrive on poor coal. Then, too, it makes a great difference in the manner it is fed to us, just the same as their grub does to them. Many a time have I seen a new watch come into the fire-room just after they have gorged themselves and overloaded their stomachs at the dinner table. Mighty little work they do then for an hour or so, but sit around and smoke until their food gets digested. Yet they are the same fellows who fill up my furnaces to the crown sheets, slam the doors shut and expect me to make steam. Well, I have learned a lesson from them in that respect, as I simply loaf along and smoke, too, until the coal gets down so that I can burn it.

"Again, I have often heard them growl because the cook puts too much grease in their grub, yet they don't mind how much grease they put into my system in the feed water. I don't know just how grease affects their internal parts to make them look so disagreeable, but I do know that it makes me feel kind of queer when it settles around my tubes and crown sheets. Often I think that one of my crown sheets will surely collapse from the sickening stuff, and were it not for the fact that they occasionally rub it off while we are in port, I know that those parts of my anatomy would have given out long ago. Although they do get the grease off the tops of my furnaces, there are lots of places in my interior where the grease has settled that they don't attempt to clean off at all. I know from the way that I feel that the spaces between my tubes are pretty well chocked up with this horrid old stuff. I can't make nearly as much steam as I did when they were new and clean, as the heat simply won't pass through the tubes into the water.

"I heard the chief say not long ago that he supposed

* For the author's former article of engine room talk see Marine Engineering, November, 1903.

he would have to buy me a new set of tubes. So far as they are concerned, it is my opinion that if the men could only get up some way of cleaning my tubes off thoroughly, there wouldn't be any necessity of putting in new ones. However, I don't care so long as I can get a new set of bright clean tubes—of course, for my reputation for economy I would rather have the old tubes work along, but I am shown so little consideration of late that I am losing all of my pride.

"Only recently that new assistant engineer had the nerve to pump a lot of cold water into me when I was running along at my top speed and 'blowing off,' because that rickety old engine couldn't handle all the steam we were giving him. B-r-r-r—but it makes me shiver now to think of what a chill it gave me. Really, I felt so badly that I began to weep at every butt strap, and even at the very ends of my tubes. I do wish they would be careful and heat all the feed water that they give me in the future. I can't stand many more cold baths like that.

"And speaking of ill-treatment reminds me that only last night that water-tender Nelson got into a trance and left my main check valve wide open, so that the water rose inside of me clear over the top of my gauge glass. I tried to call his attention to it, but he was too busily engaged in 'chewing the rag' with an Irish fireman about whether Germany or the United States had the greater navy, to pay any attention to me. I stood it just as long as I could. Finally, when I got 'too full for utterance,' as I heard a man say once, I coughed up about two barrels of water into the main steam pipe. Well! maybe that didn't wake things up!! The first attempt relieved my pent-up feelings so much that I continued to cough up water for about ten minutes, and there was certainly 'something doing' aboard this old ship for a while. From the sounds which I heard coming from the engine room I imagined that I was being 'knocked,' as the saying goes, and that Old Triple was using his water hammer. That poor youngster Nelson was half scared to death. One moment my gauge glass would be full of water, and the next there wouldn't be any in sight. They opened my furnace doors and threw wet ashes over the fires. That rather cooled down my anger somewhat, and as I had already had considerable fun with them, I calmed down a bit—the water settled to about an even half glass in my gauge, and I could hear a large-sized sigh of relief coming from Mr. Water Tender. I'll bet that young fellow won't care who has the largest navy for a long time to come."

It is hard to tell how much longer Old Scotch would have continued his musings had he not been brought to life again by No. 4, over in the opposite corner of the fire-room, shouting out, "Wake up there, Pop, your fires are going out!"

"I'll 'pop' you, you impudent young scoundrel," retorted Old Scotch, now thoroughly aroused and angry. "You pay attention to your own fires, and I'll look after mine. If you only did half the work that I do, you wouldn't have to be stirred up with a slice bar every five minutes, like you have all this trip."

"That's all right, old man," snapped No. 4, " if I only had half as much of the draft that you are always getting I would never have to be punched with that old slice bar; you are simply the windiest old boiler that ever went to sea, and it's no wonder they don't have to use a slice bar on you."

After a few spiteful exchanges of compliments of this sort, things soon settled down to normal conditions again in the fire-room. Although Old Scotch cordially dislikes No. 4, he was, on the contrary, particularly friendly to his consort, No. 2, and they worked together without any friction or ill feelings. They exchanged confidences with one another and were often heard talking softly during the long mid watches through which they had passed together.

One night No. 2 whispered to his companion that he had not been feeling well for several days, and said that he knew he was in for a spell of sickness. When Old Scotch asked him to describe his symptoms he replied that it felt as if there was something gnawing at his vitals, and that he occasionally felt a sharp twinge of pain in the region of his furnaces. For a few moments Old Scotch was silent, as if engaged in deep thought; then, as if he had been a doctor and had just made a correct diagnosis of the case, he said, in a confident manner:

"Ah! I think I know what is the matter with you. You are getting a bad attack of galvanic action. The symptoms you describe are very similar to those I felt two years ago when I had a mild attack of the same disease, which has carried off so many of our most robust boilers. It is very insidious at first, but if it is allowed to go on it will wreck the very strongest boiler constitution. Now, I wouldn't advise you to consult any of these quack doctors when we get into port, for they will only fill you up with their patent compounds, and won't do you any good. What you need most of all is a good, large dose of zinc properly applied. By that I mean that it should not be thrown in your interior hap-hazardly, as is too often done, but it should be administered in small iron baskets clamped to some of your braces, and so arranged that the zinc will have a metallic contact with your body. With this treatment you will need occasional doses of salts (sal-soda) to keep the acid out of your system. Acid, you know, is what starts this disease, and after it has worn the mill scale off your surfaces, old galvanic action gets in his work very quickly. When they examine you, if they find any pits in your skin, you had better have them washed out thoroughly with a little soda, and then filled up with a little of that Portland cement salve. You won't look very pretty, but it will be much better than having your constitution undermined by this dread disease, which I suppose some humans would describe as boiler tuberculosis.

"Ah!" he sighed, "we boilers have our troubles, as well as do our masters. What, with fatty degeneration of the crown sheets, pitting of the vitals, corrosion of the skin, poor circulation, bronchitis of our air tubes, weeping of butt straps and other sinews, stoppage of the water pipes, dislocated checks, and so on, it is about all a poor old boiler can do nowadays to keep sufficient health to earn an honest living."

"Aw! go on,'" shouted out the impudent No. 4, who had been listening to the conversation. "Don't feel so

bad about it—forget it, or the first thing you know you will commence to weep again and then you will have to have one of those boot-legged calking tools shoved into your gills—that will make you grouchy for a month." Poor Old Scotch was too much overcome with the contemplation of the ills to which all boilerkind are susceptible to make reply to such unsympathetic remarks.

As they were now on their last day's run before arriving at their home port, speculation was rife in the boiler colony as to whether they were all to be given a general overhauling and a good rest or not. Poor No. 2 would occasionally wince with pain, and declare that if he had to make another trip without being doctored up he knew that he could not stand it.

After they arrived in port and the cargo had been discharged from the ship's hold, the superintendent made a general inspection of the vessel, and found her greatly in need of repairs. As she had been a good moneymaker, it was decided to haul her off for three months and make a thorough job of it.

All of the boilers were first given a good cleaning, the covering was stripped off and each given a fine painting of red lead. Old Scotch was found to need a new set of tubes, and he was therefore fitted with the best set of new seamless-drawn steel tubes that money could buy. No. 2 had all his pits treated, and No. 4, it was found, needed a soft patch in his back connections. This, as Old Scotch facetiously remarked, was necessitated on account of No. 4 being so lazy that he couldn't even keep his own back connections warm, and that in consequence they shook a hole in their sides. At any rate, when that family of boilers buckled down to business again they were as happy and contented a lot of steam generators as ever lifted a safety valve.

Old Scotch did very little growling, and with his new set of tubes was more the monarch of the fire-room than ever before. As they were passing out by Sandy Hook on their first trip since being rejuvenated, he remarked to No. 2: "Say, partner, if these fellows in charge of us only treated us a little more like human beings, we wouldn't cost them so much money for repairs. Eh? It's man inhumanity to boilers that hurts."

QUERIES AND ANSWERS.

Q. 195.—Would you please answer the following in your next number:

I am engineer of a steamer with the following: engine, compound, surface condensing, 14 and 28 by 22 inches stroke, carrying steam at 110 pounds gauge or 125 pounds absolute. Engine turns 136 revolutions per minute with an 8-foot 6-inch pitch of wheel; a 3-inch rudder post of round iron is replaced by one made of wood 10 inches square and only 3 feet 4 inches from the after side of the propeller. The boat draws 8 feet 6 inches of water when not running, but at full speed draws 10 feet 6 inches. Before the change she would steam 10 knots at 136 revolutions per minute, and afterwards only 9 1-4 knots, the revolutions being the same. I claim it is the post that does the harm. Will you please give me your opinion of the matter, and would there be any benefit in putting a feed coil in the exhaust of the low-pressure cylinder, the exhaust being from 5 to 10 pounds gauge and 24 inches. I get a feed temperature of 120 degrees and would like to increase it if possible by having a coil in the exhaust. What length or area of tube surface would be required and what degree of heat would be given to the water supposing it to be 120 degrees on entering the coil? Would you also be kind enough to inform me if there is any mechanical power gained by having the feed water heated by live steam from the boiler, and if not, why? L. W.

A.—A falling off of three-fourths of a knot in speed seems to be a serious loss to charge against the fitting of a new stern post; still, the substitution of a square post ten inches on the side for a round post three inches in diameter would undoubtedly introduce a serious drag at the stern. Your proposition of putting a feed coil in the low-pressure exhaust is of doubtful utility. Your statements regarding the pressure of the exhaust and the vacuum are not quite in agreement. If you are able to carry 24 inches vacuum the exhaust pressure in the cylinder should not be over five pounds. With this pressure the temperature would be somewhere about 160, and you could, of course, readily heat up your feed water to some extent. In order to make any such arrangement reasonably effective, however, a coil of very large size would be required. It would be, of course, entirely out of the question to place any such coil in the present exhaust discharge, as you seem to suggest. Any such attempt would simply block the discharge, and result in a most serious increase in the back pressure.

The only way in which you could arrange matters satisfactorily would be by passing the exhaust through a regular feed-water heater on its way into the condenser. By this means, and with a large heater, you could probably raise your feed to something like 140, and this would of course represent a direct gain. It may be questioned, however, whether you could not do better with a smaller heater into which you could lead steam from your auxiliaries, pumps, etc., such exhaust having a much higher pressure and temperature, and thus giving you a much more vigorous action on the feed water.

There is no direct gain, in terms of heat, in using a heater provided with steam direct from the boiler. You can easily see the reason of this by noting the fact that the operation as a whole involves simply the taking of heat out of the boiler in the steam which is used and putting exactly the same amount back again in the feed water which is heated up. It is simply an even exchange, and, omitting loss due to radiation, the transfers of heat in the two directions would exactly balance off, and there would be left neither gain nor loss. Actually we might expect some slight loss from radiation. It does not follow, however, that the use of such a feed-water heater may not be on the whole desirable. Many engineers believe that hot feed water is very much easier on a boiler, and that the operation of a boiler is more uniform and possibly more efficient when fed with water as near the temperature of vaporization as possible. These considerations have relation primarily to the operation of the boiler and engine, and independent of the question of any actual gain or loss in terms of heat units, may amply justify the use of a feed heater of the kind mentioned. Usually, however, the best all-around results may be obtained by using a heater of size suitable to the work in hand, and leading to it the exhaust from the various auxiliary engines and pumps, by which means you should be able to raise the temperature of your water to somewhere between 160 and 200, or possibly even higher. The amount of surface suitable may be taken as about one square foot of brass tube surface for from four to six I. H. P.

Q. 196.—Will you kindly advise me the thrust, in pounds, on propeller, for vessels of 600 horse power and 12 knots speed; also advise how it is calculated, and whether the thrust is greater if the vessel runs slowly than it is if it runs faster?

E. A. R.

A.—The thrust is calculated in this way. The thrust power is the power represented by the work done at the thrust block, and is measured by the actual thrust multiplied by the speed. Now, with fair propeller efficiency, the thrust power will average about two-thirds the indicated power, or in the present case, about 400 horsepower. This is therefore the product of the thrust by the speed in feet per minute. Hence we have for the thrust the following expression:

$$T = \frac{400 \times 33{,}000}{12 \times 101.3} \text{ pounds.}$$

This figures out slightly less than 11,000 pounds, but due to the fact that the 400 was no more than an estimate of the thrust power, we may take in the given case 11,000 as a fair estimate of the thrust in pounds.

Since we divide the thrust power by the speed to obtain the thrust, it is clear that for a given power the thrust will increase as the speed decreases. Thus at 6 knots with the same power as in the present case the thrust would be twice as great, or about 22,000 pounds, while at 24 knots and the same power it would be only one-half as great, or about 5,500 pounds. Of course these various conditions could not exist with one and the same boat. They simply show the values of the thrust which would correspond to 600 I. H. P. at the various speeds mentioned.

PERSONALS.

Robert S. Hubbard has accepted the position of superintendent of steel hull department with the Townsend-Downey Shipbuilding Company.

George C. Cook, naval architect, has changed his address from Water street to 52 Broadway, New York, N. Y.

M. P. McDonagh, who formerly held the position of inspector of hull and material (special mechanic), Navy Department, at the works of the W. R. Trigg Company, has resigned and accepted a similar position with the United States Engineer department at the works of G. A. Gilchrist, Belfast, Me.

F. Miriam Wheeler, manager of the marine department of the George F. Blake Manufacturing Company, New York, N. Y., is about to retire on account of impaired health. For thirty-four years Mr. Wheeler has been engaged in the pump business.

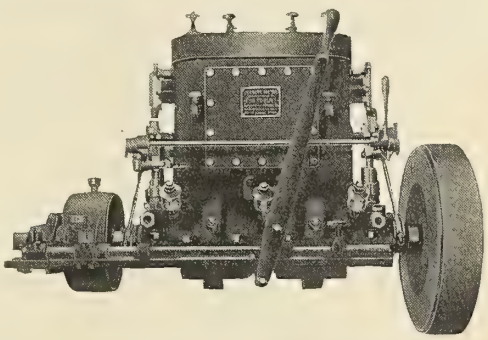
Harry R. Cobleigh, formerly connected with the advertising department of the Crocker-Wheeler Company, Ampere, N. J., has undertaken the duties of mechanical editor of the *Iron Age*, New York, N. Y.

Monthly Shipbuilding Returns.—The Bureau of Navigation reports 46 vessels of 13,992 gross tons built in the United States and officially numbered during the month of January, 1904. The largest steel steam vessels included in these figures are the *Duluth*, 4,623 gross tons, and the *Père Marquette 14*, 2,531 gross tons.

ENGINEERING SPECIALTIES.

The Toquet Motor.

One of the smaller gasoline marine motors which has met with marked favor is that manufactured by the Toquet Motor Company of Saugatuck, Conn. The reason of its success is, it is claimed, due to the fact that the motor is well designed and that none but the best material and workmanship enter into its construction. This motor is a 2-cycle one and all sizes, down to the smallest 3-horsepower size, are built with two cylinders. Both cylinders are in one casting, which insures a perfect alignment to all working parts. It is fitted with an inside reverse gear and governor, which makes it extremely easy to handle; is only 11 3-4 inches from center shaft to the top of the polished brass cylinder head, and about 30 inches in over-all length including reversing gear. It is claimed that the engine runs as smooth as a sewing machine. It is built very light and yet the metal is so placed that strength and durability are not impaired. The small size is specially adapted to canoes, skiffs, and small auxiliaries.



SMALL 2-CYLINDER GASOLINE MOTOR.

The larger sizes, of 5 and 8-horsepower double-cylinder motors, are of the same design and grade, and, it is stated, that on account of their light weight they are displacing rapidly the heavy machines of the more common type. By means of the double cylinder the vibration, a very marked objection to the single-cylinder motor, is overcome. Two special features of this make are the proper lubrication of the crank pin, which is not to be found in many 2-cycle types, and, second, eliminating the difficulties of poor contact. The rocker arm of the movable electrode in this motor is so arranged and constructed that it is always kept cool and thoroughly lubricated.

Combined Reamer and Countersinking Tool.

In steel shipbuilding, the reaming and counter-sinking expense is no small item. The present method, which the Luckhurst tool, herewith illustrated, aims to supersede, involves two sets of operators; the first consists of two workmen who, with an air motor, ream the hole, and they are followed by a second gang doing in like manner the countersinking. With the Luckhurst combined tool fitted to a motor, the two workmen first ream the hole and then simply lower the motor until the

countersinking part of the tool takes effect, the motor never necessarily ceasing in its turning from the beginning of the reaming until the countersink is complete, the time consumed in passing from one operation to the other being practically *nil.* Since the new tool accomplishes both duties by one operation, eliminating the shifting of tools and time taken up by twice covering the same ground, a great saving is made of labor over the double gang arrangement, a saving, it is claimed, of 33 per cent.

But this saving to the builder must not be considered the tool's only accomplishment. It will appeal to prospective users mainly in its assuring at all times a countersink concentric with the rivet hole, for the intermediate neck on the tool guides the countersink and

A COMBINED REAMER AND COUNTERSINKING TOOL.

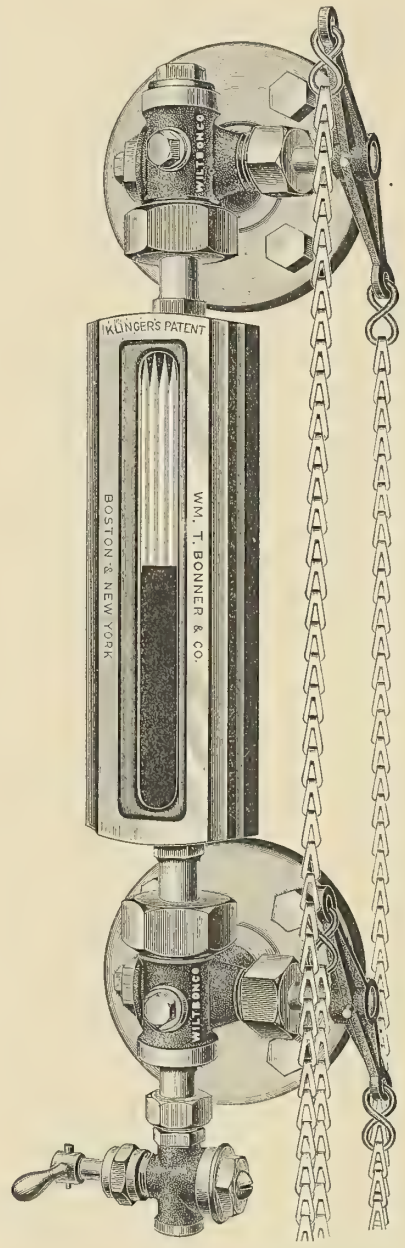
determines perfect work. The countersink angle can at no time be eccentric to the opening. The time lost in cutting out condemned rivets and reriveting is the most provoking part of hull erection, and the loss in money on a large ship amounts to several thousand dollars. By actual demonstration this combination tool has shown that the cutting out of rivets is so small as not to be considered.

The tool has already met with government use and endorsement, and is in daily use at the New York Shipbuilding Company's plant, the Maryland Steel Company's ship yards and others. Captain Allen Luckhurst, of Philadelphia, is the inventor and patentee and The Scully Steel and Iron Company, Chicago, sole manufacturers and sellers.

Reflex Water Gauges.

Marine engineers generally have observed with keen interest the progress of the first flotilla of United States torpedo destroyers from Norfolk to the Philippines, via the Suez canal. After leaving San Juan the flotilla was at sea for two weeks until Cape Verde islands were reached. The longest single run covered by the itinerary was about 2,300 miles, the total length of voyage being something over 18,000 miles, and the time required was but 15 weeks, while that according to schedule was about 5 months.

Before starting on this voyage the *Bainbridge, Chauncey, Dale, Barry,* and *Decatur,* the five destroyers constituting the flotilla, were thoroughly overhauled and refitted at the Norfolk navy yard, and great care was

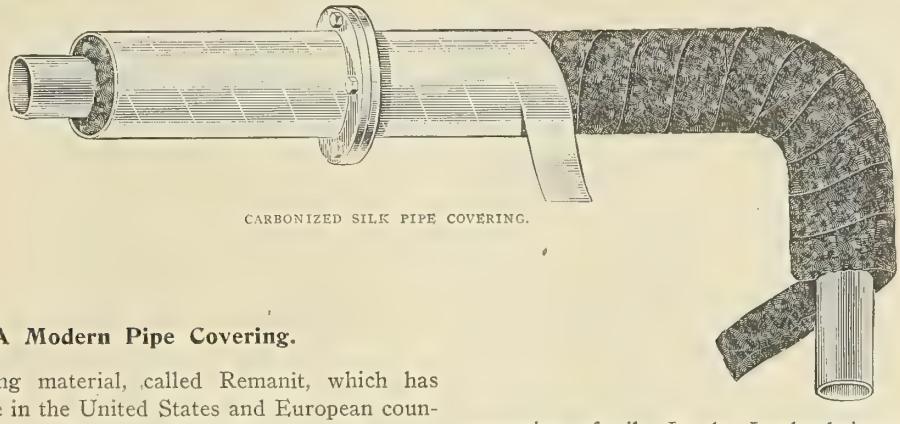


PATENT WATER GAUGE AND GAUGE MOUNTINGS.

exercised in the selection of such devices and equipment as could be counted upon with absolute certainty to insure the safety of the ships in all kinds of weather, and for unlimited periods of time during which they might not be able to put in at any ports for repairs. Naturally special care was given to the engine and boiler mountings, and the engineer officers were all of one mind in demanding the installation of water gauges which they

knew would be perfectly reliable. The accompanying illustration of the Klinger reflex water gauge and Wiltbonco gauge mountings has been reproduced from a photograph of one of the actual outfits as supplied by the manufacturers, Messrs. William T. Bonner and Company, of Boston and New York, to each of the boilers on the five ships named.

The special feature of this gauge is the facility with which the water level can be determined at all times, even though the gauge be located in a dark corner where the ordinary water glass would fail to show whether the gauge is full or empty. When filled with water the reflex gauge always appears black, as though it contained ink. When empty it shows a silvery white. This effect is produced by the peculiar shape of the observation glass, which is cut on the inner surface with prismatic grooves, thus preventing the rays of light from passing through until such time as the grooves are filled with water. It then becomes transparent and one can see through the glass and the water the dead-black background of the chamber inside.



CARBONIZED SILK PIPE COVERING.

A Modern Pipe Covering.

An insulating material, called Remanit, which has been in service in the United States and European countries for a number of years, is very different in structure, and in the method of applying, from any other form of covering. In a series of elaborate comparative tests made with this and other pipe coverings the results showed Remanit to be the most efficient of all. The best pipe covering is the cheapest, as pipes, especially steam pipes, are covered to reduce radiation and thereby save coal.

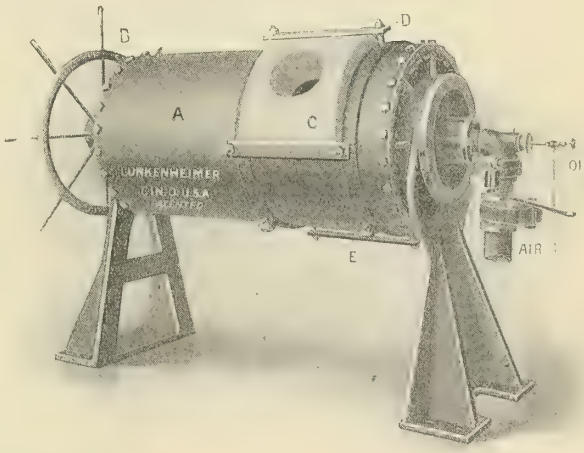
The covering is made of carbonized silk, which is an exceptionally poor conductor of heat. It will not deteriorate; fits any size of pipe or fitting; is lighter than other coverings; is easily applied or removed; is moisture-proof, and protects the pipe against rust. These are some of the advantages claimed for this covering.

As will be seen from the cut, the method of applying is very simple. It consists of wrapping the material, which is made up in flat strips, around the pipe. An outer covering is then wound around in the opposite direction and the work is complete. The flexibility of Remanit for working around elbows and fittings is very evident. It is adapted for use on steam pipes, hot-air and hot-water pipes, lagging cylinders, cold-water pipes, tanks, gas pipes, refrigerators, ice boxes, wood and iron buildings. This material is handled by Emil Frank, 1127 Broadway, New York, N. Y.

New Metal-Melting Furnace.

The metal-melting furnace here illustrated was designed after experimenting with nearly every type of furnace on the market, and is found to afford a very efficient method of melting metals, especially brasses and bronzes. As will be seen from the cut below, the furnace consists of a cylindrical sheet-steel drum *A*, having cast-iron heads. The interior of the drum is lined with fire-proof tile, and there are two openings on opposite sides of the drum. Only one of these openings is in use, the other being closed by a fire clay filling. The object of having two openings is to increase the life of the linings of the furnace. It has been found that the furnace wears out sooner around the filling hole (which also serves as outlet for the flame) than elsewhere. The advantage that this furnace has over all other makes is that when one filling hole is worn out this can be closed by a fire-clay filling and plate, the furnace reversed, and the other hole cut out and put in service.

The oil burner is of a special type, designed to give the greatest amount of heat with a minimum consumption of oil. In the Lunkenheimer foundry there are ten of these furnaces in use, and they are able to



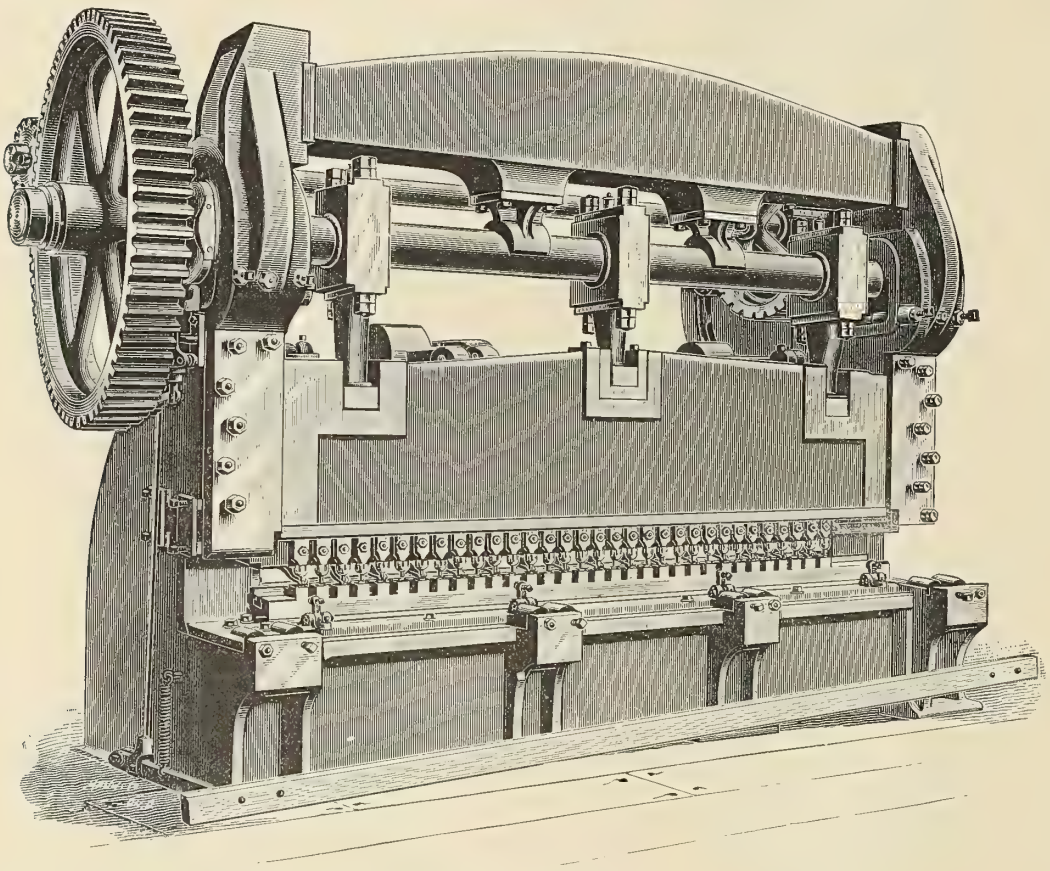
A NEW METAL MELTING FURNACE.

secure from six to seven heats per working day of ten hours from each furnace. The weight of each heat will average about 550 pounds, and the oil consumption

varies from 2 to 2 1-2 gallons of crude oil per 100 pounds of metal melted.

The life of the linings is from 300 to 400 heats, this varying due to the kind of metal melted. The whole furnace is of a heavy and substantial construction, and will be found very durable. On account of the simple form of the tile it is very easy to re-line, an objection which was found in some other types of furnaces. This furnace is made in two sizes, one with a capacity of 550 pounds of metal per heat, and the larger size having a capacity of 1,200 pounds of metal per heat.

The manufacturer, the Lunkenheimer Company, Cincinnati, O., sends an expert with the first furnace sold to each customer within 1,000 miles of Cincinnati, to start the furnace and take off the first heat and instruct the furnace-room employees how to secure the best results in handling.



DOUBLE-GEARED POWER MULTIPLE PUNCH.

A New Multiple Punch.

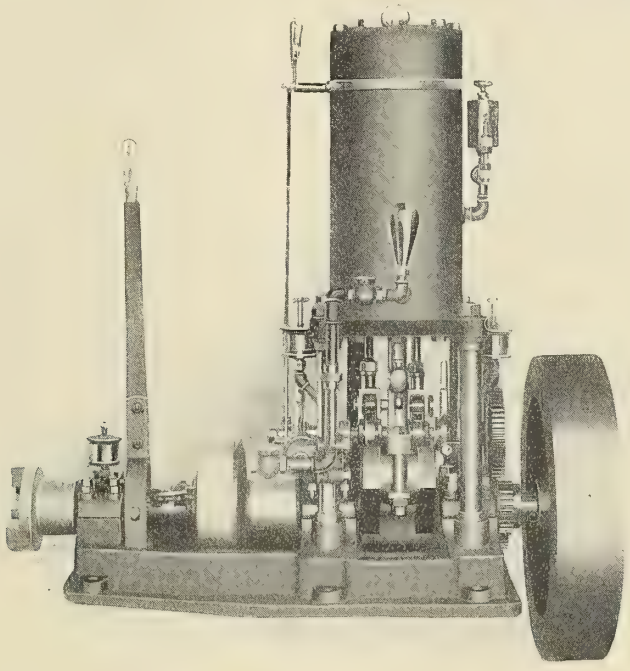
The illustration above is of a heavy double-geared power multiple-punch machine of new type for punching a series of holes through plates up to 3-8 inch thick and 9 feet long. This machine is massive in all its proportions, hence capable of heavy duty without undue straining. The hammered steel cam shaft is, as shown in the cut, of triple throw, that there may be no springing in the center when the punch is working to its designed capacity, and above the shaft there is a supporting arch with two bearings which further contribute to its rigidity and strength.

The main bearings of the cam shaft are enclosed in the main housings, instead of there being half boxes bolted on top, thus there are no bolts to work loose from the continued up-thrust of the gate. These journal boxes have an adjustable wedge seat for taking up the wear of the shaft. The arch is inserted at the ends in the housing, instead of being bolted on top, and for the reasons similar to those above. The pendulums are made so that adjustment is obtained for the punches as they wear shorter.

The gate is extra high, hence has extra long bearings at the ends, insuring accuracy and reducing the breaking of punches to a minimum. There is also a center bearing at rear of the gate to stiffen it and preserve perfect alignment. Each punch and die holder is separate and adjustable for different intervals. The clutch is steel faced, the gears are extra heavy machine mold and the clutch slides on main shaft which is square at the clutch point, hence there are no key ways to weaken the shaft or keys to make the clutch stick. The machine may be arranged for belt, engine or motor drive and may be also used for shearing. This machine is built by the Cincinnati Punch and Shear Company, and handled in the East by The J. R. Vandyck Company, of New York and Philadelphia.

Marine Engine for Heavy Work.

The Lacy four-cycle marine gasoline engine, here illustrated, is of 15-horsepower, and was specially designed for working boats and small tugs. It was built with great care and of the best materials, and, it is claimed, has all the essentials for long life under hard and continuous service. The most striking feature of this engine is the absence of the crank case, as the engine is the four-cycle type, compression takes place in the cylinder itself. All the lower portion of the engine is, as will be seen in the illustration, exposed for the engineer's inspection. A loose bearing may be readily detected and quickly adjusted, for all bearings and every nut are accessible and require no special tools or wrenches.



4-CYCLE MARINE GASOLINE ENGINE.

Very liberal bearing surface is allowed throughout. The exhaust and inlet valves are exceptionally large in diameter, thus allowing short lift, and thereby increasing the life of the entire valve gear. Ignition is by the jump-spark system, which the builders have found to be the most reliable and satisfactory method. The speed of the engine is at all time under perfect control of the engineer, whether pulling full load or running light. A feature which warrants special consideration is that the engine may be installed in any cabin boat without in any way mutilating the cabin. Although it is a large heavy machine, it may be taken apart and shipped on board through a hatchway or window of 15 by 30 inches. Any of these engines, up to and including 60 horsepower, will go into a cabin boat through the ordinary doors. The dimensions of the bedplate for the 15-horsepower machine are 48 by 28 inches, and the height of the engine over all when assembled is 52 inches, the weight is about 1,500 pounds.

The builders of this engine, the Lacy Brothers, Toledo, Ohio, also make engines of the two-cycle type in sizes from 1 1-2 to 40 horsepower, which are specially designed for light, high-speed service.

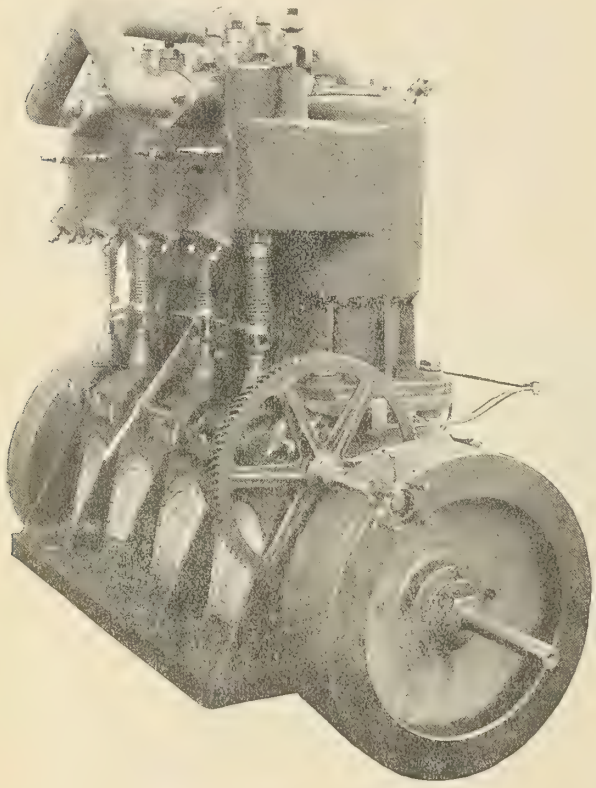
Adami Marine Gasoline Engine.

The engraving on the next page shows the gas engine fitted on board the launch *Espero,* built by Messrs. G. Adami and Company at Virenze, Italy. Simplicity, strength, light weight, and high efficiency are the features observed in developing this motor of large horsepower. As will be seen in the cut, there are two pairs of cylinders, with two cylinders in each pair, cast together. The cylinders are of four-cycle type. The base is of cast iron, in one section, with hand plates in front of the crank for getting at the connecting rods and crank shaft when necessary.

While there is a direct system of lubrication leading to large bearing, the moving parts are also lubricated by the cranks dashing through an oil bath at the bottom of the bed casting. The crank shaft is of forged steel supported by five hard bronze bearings, and the connecting rods are also of forged steel of double T-section.

While it was intended to run the motor at about 400 revolutions, the speed of 1,000 revolutions was reached without difficulty and without abnormal vibration. From indicator card it was found that the maximum compression pressure was 95 pounds, while the back pressure was but 4.4 pounds per square inch. The cylinders are 8 inches in diameter by 8 5-8 inches stroke, yet the engine is easily started by hand. The valves are operated by a gear-driven shaft on the front of the engine,

as seen in the illustration. The carburetor is at the back of the engine, a mixture of gas oil coming up through the pipe over the center of cylinders.



ITALIAN 2-CYLINDER, 4-CYCLE MOTOR.

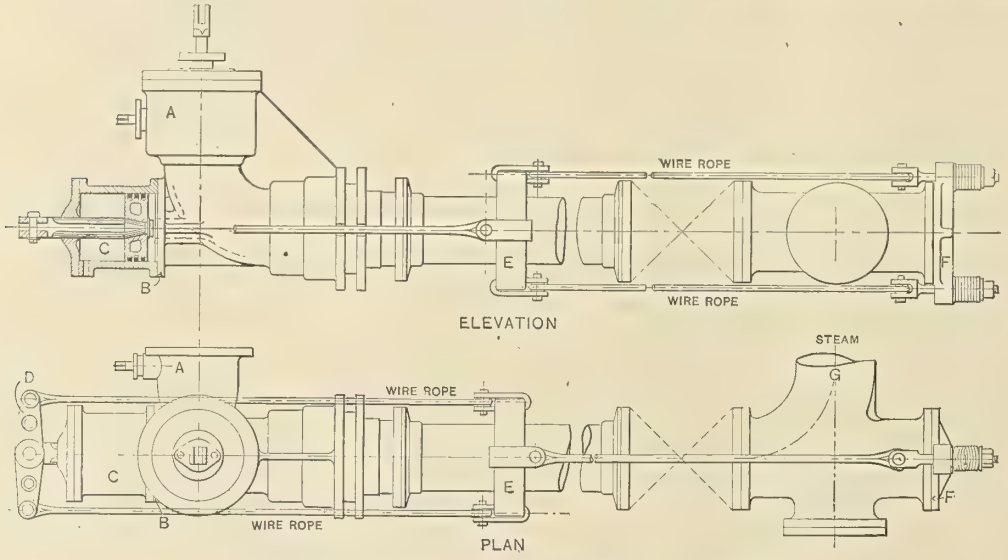
The *Espero* is 50 feet long and draws but 39 inches of water. At an engine speed of 400 revolutions the boat is driven at a 13-knot rate, about 70 I. H. P. being developed. When running at maximum revolutions 108 horsepower is claimed to be indicated.

Balance Cylinder for Steam Pipes.

In view of the importance which the subject of steam pipes on board ship was given at the recent meeting of the Society of Naval Architects and Marine Engineers, the balance cylinder for the main steam pipe, patented by Robert Sproule, consulting engineer, 205 Huxbridge Road, London, West, is of special interest.

In the case of a large steamship careful observation with full steam pressure and boiler stop valves open, showed movements of the main steam pipe varying from 1-4 to 1 7-16 inches, while the bulkheads to which they were anchored showed movements varying from 1-32 to 3-16 inch, which shows the stresses and strains which have to be taken, first by the boilers and engines, and ultimately by the hull. The means by which both machinery and hull may be relieved of this strain are seen in the device illustrated herewith, the steam from the boilers entering the fitting at the right hand at the point *G*, the throttle of the engine being at *A*.

The balance cylinder is used in conjunction with the ordinary slip expansion joint, and it comprises a regulator valve *A* of the ordinary type, except that it has a facing surface *B* cast on it with an opening through it as shown in dotted lines. On *B* is bolted a cylinder *C*, having a bore equal to the external diameter of the steam pipe. To the cylinder is fitted a piston with a stout cast-iron rod, to which is attached a swinging cross head, *D*, from each end of which wire ropes are carried to the ring *E*, to which they are attached by shackles. Similar wire ropes are brought from *E* and connected by coupling bolts to lugs on the blank flange *F*. The action is as follows: When the boiler stop valves are opened the steam passes along the main steam pipe and through the opening in *A* into *C*, forcing the piston out and putting a tensile stress on the wire ropes, which stress they transmit to the blank flange *F*, on which the internal and external pressures now balance each other. The main steam pipe is now in a state of perfect equilibrium and flexible, in the sense that it can give freely at the expansion joint with the

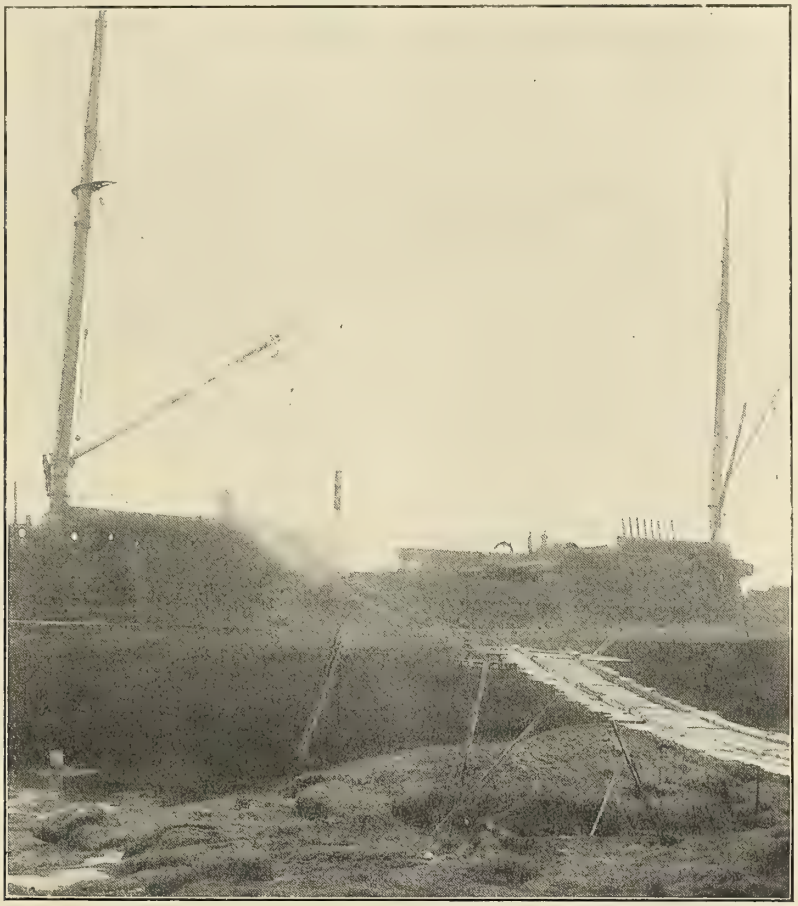


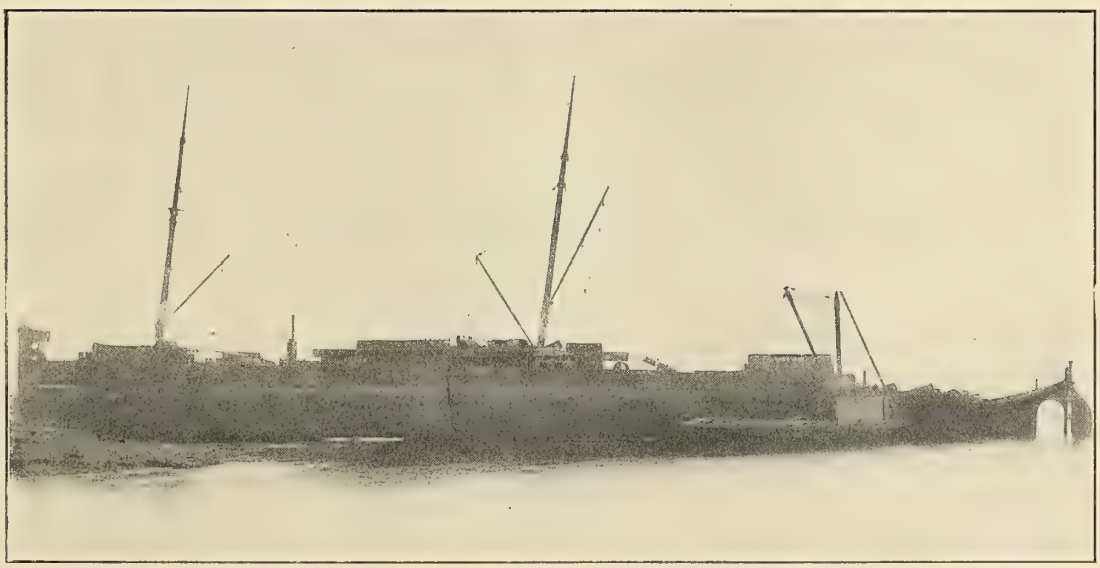
CYLINDER FOR BALANCING STEAM PRESSURE IN A STEAM PIPE.

working of the hull in bad weather. There is no force tending to cant the boiler stop valve, and a further advantage is that the bolts at the flanges of the pipe are relieved of all tensile stress due to the steam pressure. By interposing springs, as shown at *F*, the shock in case of waterhammer in the pipe when starting would be cushioned.

The Steamship Lake Superior Wrecked.

The total loss of the steamer *Lake Superior*, following accidental grounding in the harbor of St. John, N. B., is another illustration of the serious damage a ship may sustain whenever she comes in contact with anything but her native element.





STEAMSHIP LAKE SUPERIOR, BEING BROKEN UP IN THE HARBOR OF ST. JOHN, N. B., WHERE SHE WAS WRECKED.

A pilot was taken on board the *Lake Superior*, of the

Elder-Demster Line, as she entered the port bound from Liverpool, on March 28, and it was decided to bring the ship to anchor in the upper quarantine station. The tide had been flowing ebb for one hour and a half, but the vessel easily proceeded to the spot where it was intended to moor her. Her engine was stopped and the starboard anchor dropped, but the vessel was caught on the port bow by the very heavy tide and carried broadside on to Round Reef. Six tugs failed to float the steamer on following high tide and several other attempts all proved futile. At each outgoing tide the vessel was left so high and dry on the reef that her bottom was badly damaged. Cargo, coal, and all removable equipment was lightered ashore, and she was finally floated, but the hull was found to be in such a damaged condition that the steamer was sold at auction. Miller and Company, of Boston, bought her for $26,500 for scrap, so the vessel was beached at high tide and broken up, in the course of which operation she is illustrated. The removal of the upper plates weakened her to such an extent that she broke in two, as shown in the engraving, just aft of the midship house. The means of getting the material ashore was by a cable railway, the cables made fast to the masts of the ship and to the rocks on shore.

Electric Club Journal.—A new magazine, entitled the *Electric Club Journal,* appears in February of this year. It is published by the Electric Club of Pittsburg, Pa., which has been organized to provide a means for effective co-operation among Westinghouse men. In the prospectus of the *Journal* the editors state that articles will be made up chiefly from selections from the technical proceedings of the club. The magazine is paper bound, containing 54 pages of reading matter, is 6 by 9 inches. The subscription price is $1 a year, or 15 cents a copy.

Japanese Gunners.—In an interview with the *Daily Mail's* Seoul correspondent, Brig.-Gen. H. T. Allen of the Philippine constabulary, who was appointed to accompany the Russian army, and who watched the naval fight at Chemulpho at close quarters and afterward rowed around the Russian ships before they were destroyed, said:

"I have never seen or heard of anything resembling the effect of the shrapnel fire. The *Variag* was literally peppered in parts as though she had been played on at close quarters with machine guns. Evidently time fuse shrapnel was used with blinding, bewildering effect.

"The heavy artillery work emphasizes the fact that you fire a tremendous lot and get little for it. The firing lasted fifty-two minutes and there were ten shots a minute. Only two heavy shells struck the *Variag's* hull. One shot exploded on the bridge and strikingly demonstrated the effect of shell fire, everything around being torn to tatters and resembling the debris of a machine shop. All the torpedo tubes were filled after the fight, indicating that none had been fired.

"The Russians knew evidently that they were going to inevitable death, yet they fought until their ship was unmanageable. Their commander did well to bring the ship into the harbor. Further fighting would have been madness."

TECHNICAL PUBLICATIONS.

Supplee's Mechanical Engineer's Reference Book. By H. H. Supplee. Size 4 by 7 inches. Pp. 834, with numerous diagrams and cuts. Philadelphia: J. B. Lippincott Company. Price $5.00 net.

The publisher's announcement that an engineer's hand book was in preparation by the author of this work has naturally led to keen expectation as to the ground to be covered and as to the general character of the subject matter to be included. It is naturally necessary, in preparing such a book, to select from among a great mass of detailed information such individual features as shall be the most generally useful to the engineer in the daily exercise of his profession. It becomes thus in large measure a matter of judgment with the author as to what shall be included and what excluded; as to what will be most useful in the everyday work of the practical and designing engineer, and as to what will be so rarely needed as not to justify its inclusion. Considered from this view point the author seems to have used excellent judgment and to have produced a well-balanced compendium of useful information for the daily needs of the engineer. As the author points out, the presentation of a mass of formulæ or data, without selection, and perhaps, to some extent, internally contradictory, tends to confuse the user and to throw upon him the burden of a choice where he is looking for more definite guidance. To avoid this so far as possible the author has examined the many and varying formulæ relating to engineering practice, and has given only those which, in his judgment, are most generally applicable to standard and average conditions.

The subject matter is presented under the general heads: Mathematics, Mechanics, Materials, Design, Heat, Air, Water, Fuel, Steam, Steam Boilers and Engines, Internal Combustion Motors, Electric Power, Cost of Power, Works Management.

Under mathematics and mechanics are found the usual formulæ, mathematical tables, etc. The conversion tables for English and metric measures are especially full, and the sections dealing with trigonometric formulæ and with differential and integral calculus are more extended than those usually found in handbooks of this type. The section devoted to materials includes the engineering properties of the various materials employed, together with a large number of tables giving weights, standard dimensions, and mechanical properties of classified materials of every description. Under machine design we have presented a wide selection of formulæ and methods for determining the dimensions and proportions of fastenings, bearings, shafting, gearing, pulleys, belting, engine details, etc.

Then follow sections of the book taken up with subjects relating to heat and the transformation of heat energy into mechanical form. The sections relating to fuels, steam, boilers, engines, and internal combustion motors are well stocked with useful tables, data, methods of computation, discussion of indicator diagrams, heat losses, results of tests, etc. The section on electric power contains the usual useful tables and data, and gives also the rules of the National Electric Code for wiring. There is given also a most interesting collection of tests of motors used for individual tool drive.

including description of work done, power required to run machine unloaded and when under full load. The section on the cost of power gives much valuable data regarding the cost of power developed from various sources and under various attendant conditions. An interesting addition to the usual contents of books of this character is found in the section on works management, giving in outline the fundamentals of organization and cost accounting for industrial establishments.

In the appendix are placed some miscellaneous matters not elsewhere located, among which is a table for powering steamships taken from Nystrom's handbook. The utility of this table, except as a crude approximation, may be questioned. The power is given in tabular form for regularly varying values of the displacement and speed, but quite independent of the characteristics of form. While for certain rough purposes such information might have some value, yet the power so depends on form and other special conditions that any dependence on the values thus given might be most disastrous, and it is doubtful if they should be given the semblance of reliability and value by printing them in a book of this character.

As a whole this handbook should take a leading position among like publications in the engineering field, and its many excellent qualities are most cordially commended to all engineers.

The book is published in the best style of the technical printer's art: semi-flexible leather covers, gilt edges, marginal index of main heads, excellent paper, and general make up, with good type and clear cuts and illustrations.

History of American Steam Navigation. By John H. Morrison. Size 6 by 9 1-2 inches. Pp. 630, with numerous illustrations. New York, W. F. Sametz and Company. Price, delivered, $4.25.

The purpose of the author in the preparation of this book has been to give in somewhat full historical detail the development of steam navigation in America, with especial reference to the coast and inland waters of the United States. Of the 12 chapters the first one relates to the experimental period, covering the time down to, presumably, 1825 and including an interesting resumé of the efforts of Fulton, Stevens and others in the earliest days of steam navigation. Chapters two to seven inclusive relate to the development of steam navigation in its various phases on the coasts, sounds, bays, lakes and inland waters of the United States. Chapter eight deals with ocean steamship lines, and with the larger coastwise lines not previously mentioned. Chapter nine deals with the development of ferries and tug boats, chapter 10 with the advance in speed, chapter 11 with the development of aids to navigation, including lighthouses, lightships, fog signals, steamboat inspection service and the life-saving service. Chapter 12 gives a brief history of the improvements at Hell Gate, resulting in the greater safety and facility of navigation through this crowded waterway.

There has been no attempt to give a complete history of every line of steam vessels, and many of the early records are necessarily somewhat uncertain. So far as the vessels described are concerned only those having some historic interest and embodying distinct features in hull or machinery, speed, carrying capacity or further item, giving to them some right of prominence in the historical development of the era, are described. Great effort has been made to obtain accuracy in matters of detail, but previous to 1870 completeness of detail or full accuracy is not always practicable. Since that date the journals devoted to engineering and to maritime interests furnish a basis for more accurate statements. In matters of history much is necessarily referred to the judgment of the author, and the author's personality is sure to enter to a considerable degree. In the present case it is probable that many of his statements will not be acceptable to the views of some who have formed their own opinions regarding the historical development of navigation in America, or who may be intimately acquainted with special details which may have escaped the author's notice. As a whole, however, the work seems to have been carefully and conscientiously done, and will be found of great interest and value to those who are concerned in the historical branch of the subject.

The book is well printed and the illustrations have been carefully prepared from the most reliable prints extant, and may be accepted as accurate representations of the vessels to which they refer.

The Polar Planimeter. By J. Y. Wheatley. Pp. 114, with 10 diagrams in the text and 12 folding plates. New York: Keuffel and Esser Company. Price $3.00.

The purpose of the author in preparing this work was to fill a want which he had himself met in connection with the use of the planimeter for engineering purposes. While much has been written on the theory of the instrument, there seemed to be no comprehensive and practical work dealing with the instrument as an engineer's tool, and giving the needed instruction regarding its adjustment and use. This need the author has endeavored to supply. The subject matter is presented in ten chapters dealing with the construction and theory of the instrument and with its use in dealing with a wide variety of engineering problems. The theory of the instrument is given without the aid of the calculus, and in a manner sufficiently simple to be followed by all who have an elementary acquaintance with algebra, geometry and trigonometry. The engineering applications are discussed under the general heads: measurement of areas, problems involving averaging, and the measurement of quantities of materials. These various applications are discussed in great detail and the various steps are fully discussed and clearly explained.

The treatment includes also very complete tables of factors and other data for the adjustment of the instrument, thus adding to its value as a complete office handbook for the adjustment and use of all instruments of this type. A chapter is also given on the various kinds of modern planimeters, their construction, adjustment, and use. In the closing chapter the general subject of accuracy, absolute and relative, is considered, and the results of certain experiments by Lorber are given, showing the conditions which may effect the accuracy of the instrument and the average amount of error which may be expected with instruments of typical form.

As a whole the book is clearly written and contains a large amount of matter which should be most useful and helpful to all who have occasion to use the planimeter in general office engineering work.

Commutator Construction. By William Baxter, Jr. Pamphlet form. Size 5 1-2 by 8 inches. Pp. 23, with 39 figures in the text. New York: The Derry, Collard Company. Price 25 cents.

Threads and Thread Cutting. By Colvin and Stabel. Pamphlet form. Size 5 1-2 by 8 inches. Pp. 32, with 28 figures in the text. New York: The Derry, Collard Company. Price 25 cents.

These pamphlets form numbers 3 and 4 of the series of practical papers published by this company. The purpose has been to provide a series of practical papers, each one having to deal with but one subject, and giving in clear and practical form the important points on this one subject.

The paper on commutators takes up in a clear way the design, construction, and maintenance of this feature of direct-current apparatus. No one item of such machinery is so fruitful of trouble as the commutator, and the clear explanation of the conditions to be fulfilled, the sources of the most common troubles, and their remedies should commend it to all who have to deal with this class of machinery.

The paper on screw threads explains in a clear and simple manner the nature of a screw, the standard forms and proportions of screw threads, the setting of the tool in the lathe, the cutting of the thread, with suggestions regarding the kink of catching the thread instead of waiting to run the carriage back over the length of a long thread. Double threads, cutting threads in the milling machine, chasing threads, and making the chasers are also discussed in the same clear manner. This paper should be of value to all who are interested in the special points connected with the cutting of screw threads.

The value of the paper would, however, have been improved by the addition of a section on the setting of the change gears of a lathe. It is possible that this topic is reserved for some future paper, but its connection with screw threads is so direct and vital that no more useful place for such a discussion could be found than in a paper on the cutting of screw threads.

SELECTED MARINE PATENTS.

747,393. SHIP-BUILDING. PETER EYERMANN, PHILADELPHIA, PA.

Claim.—1. A ship, the hull of which is constructed of metal tubes having external flanges, webs, fins or wings.

2. A ship, having ribs of metal tubes provided with external flanges, webs, fins or wings, and closed ends. Four claims.

747,349. KEEL-BLOCK. GUSTAVUS ANDERSON, CAMDEN, N. J.

2. Consisting of a ground or base section which gradually increases in height from its sides to its median plane, a similarly-formed, reversely-arranged, rider-section, two wedge-shaped pieces arranged between said base and rider sections, and means detachably connecting said intermediate pieces. Three claims.

747,506. OSCILLATING PROPELLER. WILLIAM B. TERRY, MARLOW, IND. TER. One claim.

747,654. PROPELLER. ROBERT W. SHAW, STAMFORD, CONN. One claim.

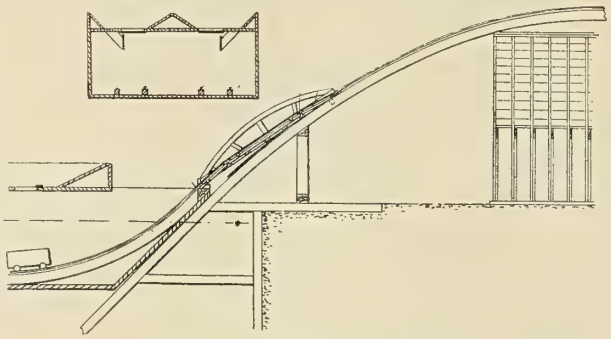
747,690. DISTANCE AND COURSE RECORDER FOR SHIPS. WILLIAM C. FORBES, ELSTERNWICK, VICTORIA, AUSTRALIA.

Claim.—1. In a distance and course recorder for ships, the combination with a meter, and a winding-drum connected therewith, of a chart, a carrier, a guideway therefor, and grips combined with the carrier to engage the chart.

2. In a distance and course recorder for ships, a compass-basin, a compass-card, an arm supported by the said card and bent around abaft and under the basin, a chart, and a recording implement carried by the arm and traversing the chart. Ten claims.

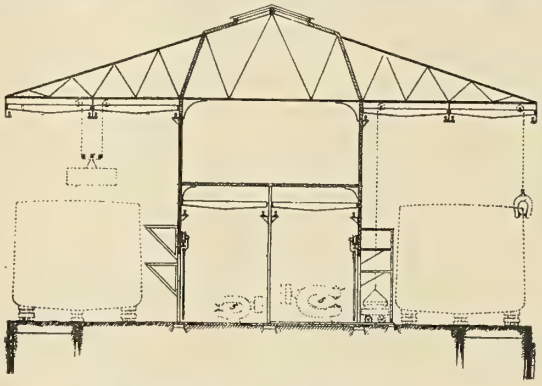
747,560. MEANS FOR DISCHARGING CARGOES. HORACE A. MIDDAUGH, SEATTLE, WASH.

Claim.—1. In an apparatus of the nature indicated; the combination of a barge having a railway-track, an upwardly-extending approach having a railway-track, a fender at the lower end of said approach, and a bridge comprising a span resting on said barge and against said approach and having a section of railway-track, and track-sections hinged to the extremities of said section on the bridge.



2. In an apparatus of the nature indicated; the combination of a barge having a hopper-shaped receptacle with gated openings in the bottom, and a railway-track beneath said openings, an upwardly-extending approach having a railway-track, a fender at the lower end of said approach, and a bridge comprising a span resting upon said barge against said approach and having a section of railway-track, and track-sections hinged to the extremities of said section on the bridge. Three claims.

747,782. SHIP-BUILDING PLANT. JOHN W. SEAVER, CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE WELLMAN-SEAVER-MORGAN COMPANY, CLEVELAND, OHIO, A CORPORATION OF OHIO.



Claim.—1. A ship-building plant comprising an inclosed structure having walls and a roof provided with a series of roof-trusses, each of said trusses having an extended portion projecting beyond said inclosure, tracks supported by the projecting portions of the trusses and extending at right angles to the planes of said trusses, and a crane constructed to operate on said tracks.

2. The combination in a ship-building plant, of an inclosed structure having a series of trusses for supporting the roof thereof, each of said trusses having portions extending on both sides of the inclosed structure, tracks supported by the projecting portions of the truss, other tracks supported on the outside of the wall-supporting framework of the inclosed structure and cranes constructed to operate upon the tracks, said tracks extending at right angles to the planes of the trusses.

3. The combination in a ship-building plant, of an inclosed structure having walls and a roof, with a series of substantially parallel trusses for supporting said roof, said trusses having portions extending outside of the inclosed structure, three tracks supported from the under side of said extended portions of the trusses, one of the same being adjacent to the outer ends thereof and the others being carried at substantially the middle portions of said trusses, with a track supported on the outside of the wall-supporting framework of the inclosed structure, and cranes operative upon said tracks and movable in lines at right angles to the planes of the trusses. Three claims.

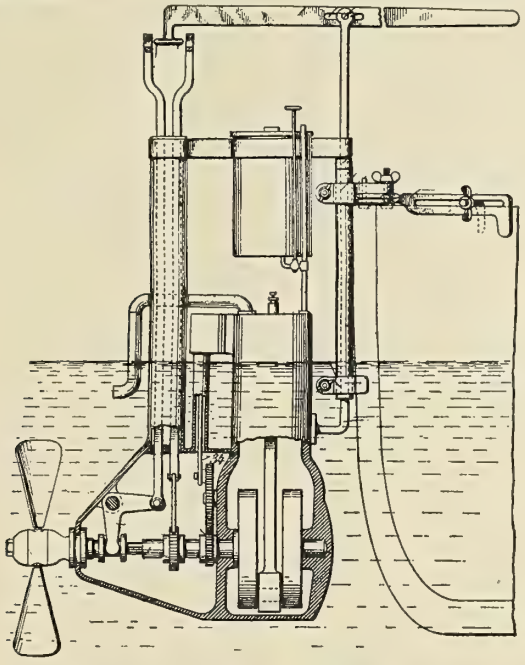
747,801. BOAT-PROPELLER. HARRY W. STURGES, WILTON, CONN.

Claim.—1. A boat-propelling device, comprising an internal-combustion motor, means for mounting the motor with a part of its cylinder submerged whereby to cool the cylinder, and a propeller in connection with the motor.

2. A boat-propelling device, comprising a clamping means, a tubular member fastened therein, a rod mounted to turn therein, a motor and propeller supported from the rod, and means in connection with the rod for turning the same to steer the boat.

3. The combination with a clamping device, of a tubular member carried thereby, a rod mounted to turn in the tubular member, a motor fastened to the lower end of the rod at an elevation sufficient to submerge the motor-cylinder, a propeller in connection with the motor, a fuel-tank carried from the upper portion of the rod, and means in connection with the rod, for turning the same to steer the boat.

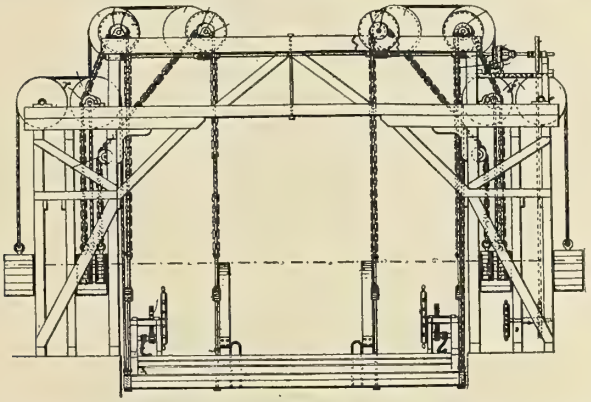
5. The combination of a motor, a propeller connected therewith, means for mounting the motor and propeller on the stern of a boat, outside thereof, and means for turning over the motor to facilitate starting the same, such means extending from a mobile part of the engine into proximity to the stern-sheets of the boat to permit operating them while the motor and propeller are in place.



6. The combination of a motor, a propeller, means for removably attaching the same to a boat, and reversing devices for the propeller-blades, said reversing devices extending from the propeller-shaft to permit reversing the propeller-blades while the motor and propeller are in place.

7. The combination of a motor, a propeller, means for mounting the motor and propeller on a boat, means for starting the motor, means for reversing the propeller-blades, and a tiller connected with the motor to turn the same to steer the boat and movable into engagement with either the means for starting the engine or for reversing the propeller-blades. Nine claims.

747,836. FERRY-BRIDGE. JOHN ANDERSON, NEW YORK, N. Y.



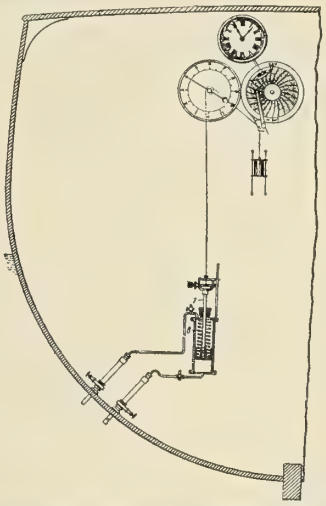
Claim.—1. The combination with a ferry-bridge, or counterbalancing means for taking up the main weight of the bridge, worm-gear mechanism, operating means therefor, and a flexible connection under constant stress between the gear and the bridge and independent of the counterbalancing means, for raising and lowering the bridge and taking strains off the gear. Five claims.

748,176. SCREW-PROPELLER. THOMAS H. EASTWOOD, McMINNVILLE, TENN. One claim.

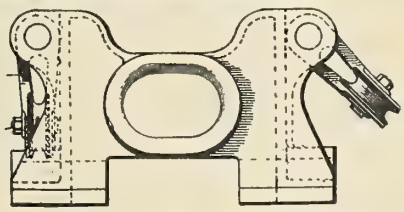
748,159. DEVICE FOR RECORDING SPEED OF VESSELS. JEFFERSON S. BRIGGS, BROOKLYN, N. Y.

Claim.—1. In a device for recording speed of vessels, a cylinder, a piston located in said cylinder, a scoop, a static pressure-tube and means for admitting water-pressure from the two scoop and tube respectively to opposite sides of the piston.

3. In a device for recording speed of vessels, a cylinder, a piston located in said cylinder, a tension device, a connection between the tension device and the piston, means whereby said connection operates an indicator, a scoop having a connection admitting pressure to one surface of said piston and a static tube admitting pressure to the opposite side of said piston. Three claims.



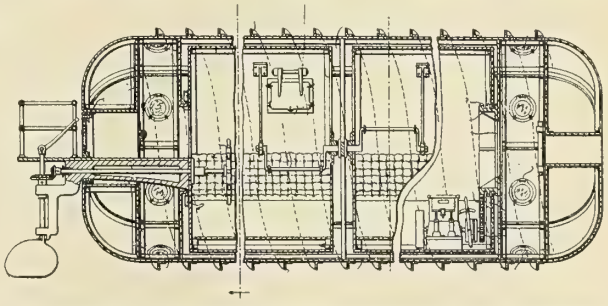
748,618. DEVICE FOR MOORING AND WARPING VESSELS. JOSEPH KIDD, DULUTH, MINN.



Claim.—1. In a mooring and warping device, the combination of a body portion, a sheave-supporting shell pivoted thereon, a sheave therein, the said shell having a mortise larger than the sheave with an enlarged opening 16 above the mortise, separated therefrom by a slot 17 adjacent to the sheave-score, the said slot being narrower than the width of the sheave. One claim.

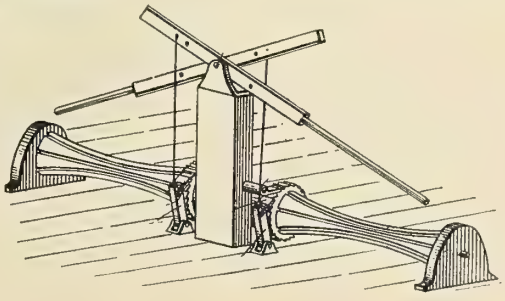
748,757. WAVE-MOTOR. JOHN A. LANGSTROTH, OAKLAND, CAL. One claim.

748,919. LIFE-BOAT. ROBERT A. BROWN, CHICAGO, ILL.



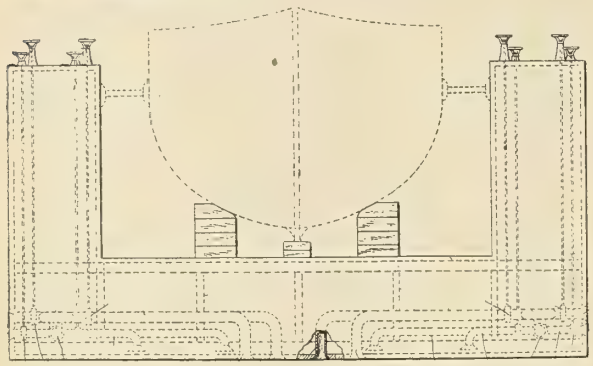
Claim.—1. In a boat of the class described, the combination of a horizontally-disposed hull of substantially circular transverse cross-section, comprising a shell of sheet metal, a plurality of longitudinally-disposed stiffening-bars secured to the inner surface of said shell, and a transversely-disposed stiffening-bar extending spirally around the outer surface of said shell, said outer stiffening-bar having an outwardly-projecting flange; a car journaled concentrically within said hull; and means for rotating said hull about said car and propelling same, through the action of said outer flange. Two claims.

749,188. SHIP'S WINDLASS. JOHN HANSEN, NORTH-COVE, WASH.



Claim.—1. In a windlass, the combination with the central standard, of the winding-drums and operating-pawls, an operating lever composed of two independent members pivoted on the same pin and adapted to be operated independently, means for connecting said members together to form a single lever, and connecting means between said members and the said operating-pawls. One claim.

749,171. FLOATING DOCK. ANDREW C. CUNNINGHAM, WASHINGTON, D. C.



Claim.—1. In a floating dock having the usual arrangement of pipes for filling and emptying the dock, the combination with the main pipe having branches leading to the several compartments, of a pump connected to said pipe to take water therefrom, and a pipe connected to the pump to receive water from the pump, said pipe opening through the bottom of the dock to discharge the water forcibly under it. Two claims.

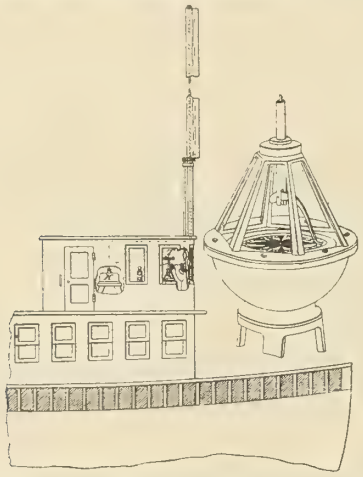
749,412. BOAT. ALBERT VIERT, CHICAGO, ILL.

Claim.—1. A hull for vessels or ships provided at its prow portion with a downwardly and rearwardly extending fin, said fin being thicker at its middle portion than at its ends. One claim.

749,427. HYDRAULIC PROPELLER FOR VESSELS. JOB DUDLEY, HAMILTON, CANADA. One claim.

748,453. PROPELLING DEVICE FOR BOATS. JAMES S. WORCESTER, NEWARK, N. J. Five claims.

749,694. MEANS FOR DETERMINING THE NAUTICAL BEARING OF NAVIGABLE VESSELS. HERMON W. LADD, BOSTON, MASS., ASSIGNOR TO GEORGE E. SMITH, TRUSTEE, EVERETT, MASS.



Claim.—1. Means for receiving Hertzian-wave signals and messages, comprising a wave-catching conductor, in combination with a shield open on one side to expose said conductor to the transmitted waves in certain directions, and closed on its other sides to shield the conductor therefrom in other directions, for the purpose set forth. One claim.

749,754. ALTISCOPE FOR SUBMARINE BOATS. LAWRENCE Y. SPEAR, GREENPORT, N. Y., ASSIGNOR TO ELECTRIC BOAT COMPANY, A CORPORATION OF NEW JERSEY.

Claim.—1. An altiscope for submarine and other boats, comprising a group of upright, altiscope optical tubes connected with the turret or conning-tower of the boat, said tubes having their image-receiving mirrors faced outwardly in different directions and having their observing-telescopes within the turret directed radially inward. One claim.

749,860. MEANS FOR LOADING OR UNLOADING VESSELS. HENRY M. HARDING, NEW YORK, N. Y. One claim.

749,909. SHEATHING FOR VESSELS. RICHARD D. UPHAM, NEW YORK, N. Y.

Claim.—1. A sheathing for vessels and the like, comprising a backing of flexible and tough sheet material, and a flexible facing compound on said backing and attached thereto, said compound consisting of a suitable insulating substance, and comminuted metal, intimately mixed and compressed. One claim.

749,920. PILE-PROTECTOR. AUGUSTUS S. COOPER, OAKLAND, CAL.

Claim.—1. A pile-protector comprising a floating substance noxious to pile-destroying worms, bugs and insects, and a dam to confine said floating substance about the pile. One claim.

747,923. APPARATUS FOR LOADING OR UNLOADING VESSELS. GEORGE H. AIREY, PARIS, FRANCE.

Claim.—In means for loading and unloading vessels wherein the goods are run down an inclined rope from the delivering to the receiving vessel, an endless-band elevator; lifting-arms outstanding from the said endless band; an inclined tube at the top of the elevator-mast through which passes the inclined rope; lifting-hooks to hang on the said lifting-arms on the endless band, the said hooks having a flat overturned part to rest on the lifting-arms and an upstanding loop above the said flat overturned part and a downturned and outwardly-sloped arm by which the hook and its load are shunted from the lifting-arm on to the inclined tube and from thence to the inclined rope. One claim.

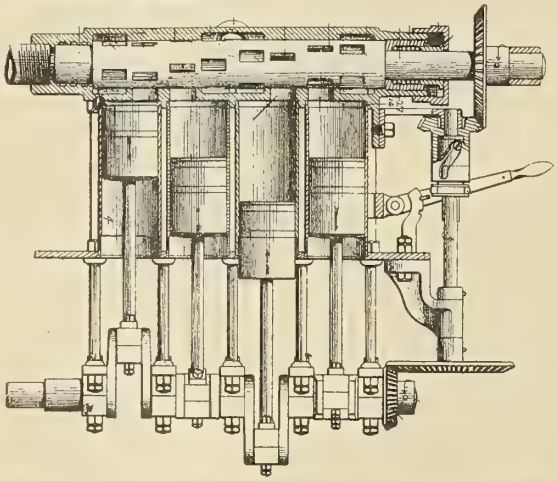
749,927. DISTANCE-RECORDER FOR SHIPS. WILLIAM C. FORBES, ELSTERNWICK, VICTORIA, AUSTRALIA.

Claim.—1. In a distance-indicator for ships, a pipe having an inlet and an outlet branch projecting through the ship's bottom, a valve in each of the branches, a worm-wheel on the stem of each of the valves, and a worm meshing with the worm-wheel and provided with an operating-spindle. One claim.

749,957. PILE-STRENGTHENER. AUGUSTUS C. COOPER, OAKLAND, CAL.

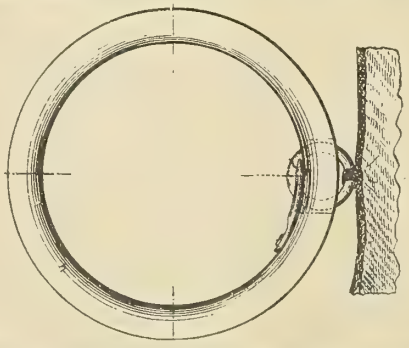
Claim.—1. A pile-strengthener comprising a plurality of braces disposed to bridge the weakened portion of the pile and to bear with their ends against the upper and lower ends of said portion, and means for tying said braces together to hold them against the pile. Two claims.

749,958. STEAM-ENGINE. CHARLES CROMPTON, WORCESTER, MASS.



Claim.—1. In an engine, the combination of a hollow bar forming a steam-chest and having a series of sockets to receive the cylinders, a series of cylinders held in said sockets, said bar having a series of steam-spaces communicating with said cylinders and a valve contained in said hollow bar, whereby the flow of steam to said cylinders is controlled. One claim.

749,968. DETACHABLE SAIL-FASTENING FOR MAST-HOOPS. ALBERT KLATT, COLLINSVILLE, CAL., ASSIGNOR OF ONE-HALF TO EMIL EMMINGTON, COLINSVILLE, CAL.



Claim.—1. A device for securing sails to mast-hoops, comprising a ring secured to the sail, a mast-hoop having an aperture to admit the ring, and a latch insertible through the ring between the hoop and the ring after the latter is passed through the aperture in the hoop. One claim.

750,036. SCREW-PROPELLER. ERNST A. NILSEN, CHRISTIANIA, NORWAY.